AMERICAN MACHINIST

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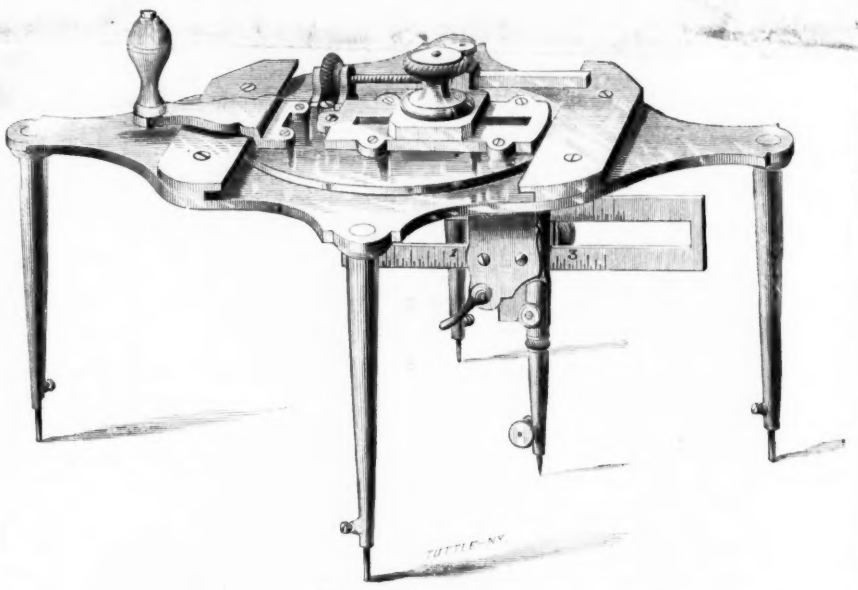
Bauer's Ellipsograph.

The instrument illustrated with this is the invention of the well known engineer, Charles A. Bauer, Superintendent of the Lagonda Works, Springfield, Ohio. It will draw ellipses with any desired variation in the two diameters. In using the instrument the pencil is revolved by the small handle shown on the top. This handle is attached to a circular disk, which is guided between two parallel slides across the top of the table. This disk has a radial slot through it, and to the top is fastened a slotted guide piece. The upper part of a piece to which the pencil movement is attached fits in this slot, forming a slide that can be moved to any position in the slot and clamped by means of the milled thumb-nut. The bar with the threaded end and small nut connects with this slide, and is used for making fine adjustments, which are read from graduations (not shown) on the slotted guide piece.

The graduated slotted arm underneath carries the pencil bar, which is adjusted by means of a milled thumb-nut. The table is slotted in a direction at right angles to that of the guides that control the lateral motion of the disk, this slot guiding the motion of the pencil in its direction.

From the foregoing it will be readily seen that the combination of movements necessary to describe any ellipse within the capacity of the instrument is provided. Thus: with the pencil movement clamped in the center of the disk, and with a corresponding central position of the pencil bar in the slotted arm, the disk will revolve without moving, laterally, and the pencil will describe a point. By adjusting the pencil along the slotted arm circles of corresponding diameters will be described, and by adjusting the top slide to other positions in the disk, and by different adjustments of the pencil bar an ellipse of any desired proportion, or a straight line may be described.

The graduations on the top slide and on the arm underneath permit the instrument to be accurately adjusted to describe the desired figure. The small lever shown underneath is for raising the pencil from the paper, when desirable. Two of the supporting legs are provided with needle points, for accurately adjusting the instrument on the paper, and for securely holding it in position.

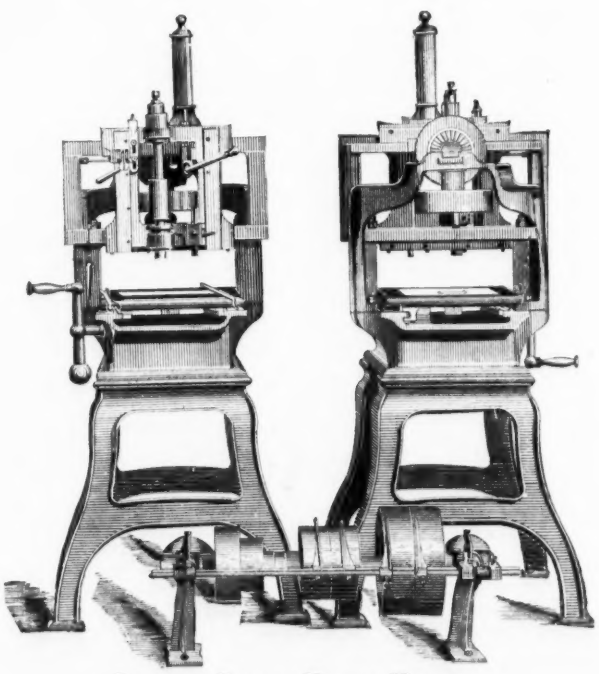


BAUER'S ELLIPSOGRAPH.

The development of the cutlery business which has made Sheffield so famous, was due to the labor of a multitude of small workshops, where the labor was done by the proprietor and perhaps his boys or two or three hired hands. This led to close competition in skill, and a whole host of small concerns struggled to eclipse their neighbors in the character of the work turned out. Emulation of this character had the highest effect in improving the skill of the different artizans. Of late years, labor-saving machinery has been by degrees putting the cutlery trade into the hands of large establishments where expensive plant could be provided. And these large manufacturing concerns have been favored by the trade associations of Great Britain, so that their goods were put upon the market in preference to the productions of small concerns. Under these circumstances the small cutlery makers got to depend upon the American market for orders. Of late the American cutlery demand has been supplied to a great and growing extent by the home makers, and in consequence the extinction in Sheffield of small makers is imminent.

Improved Profile Milling Machine.

This machine, in which is represented recent improvements, is designed for milling inside and out all metal forgings and castings of irregular shape to an exact size and shape of pattern required. The table is operated by hand or automatic feed, as desired, and has a working surface 10x14 inches, and a forward and back movement of 16 inches. The cross slide, which holds the cutter spindle, is provided with a counter-balance spring and a notch adjustment, and is operated by the hand lever shown in cut, and has a movement of 9 inches. The countershaft has adjustable self-oiling hangers, and two sets of friction clutch pulleys, which, in connection with cone pulley on machine, provides for four changes of speed. This machine, complete, weighs 1,100 pounds, and is manufactured by E. E. Garvin & Co., 139 to 143 Centre street, New York City.



IMPROVED PROFILE MILLING MACHINE.

An inventor has written us asking for information about how to dispose of a perpetual motion machine. He draws our attention to the fact that millions of dollars have been spent by inventors trying to perfect such a machine, that disappointment failed to prevent others from devoting their time and money in this direction, and that he has succeeded. He does not mention that he has succeeded in performing what is impossible, but that is the achievement which perpetual motion means. The principles of the correlation and conservation of physical forces require more extended preaching than they have yet received, since men of ordinary intelligence are yet found chasing the chimera of perpetual motion. As a matter of encouragement to such, we may mention the receipt of a circular describing a veritable perpetual motion, under another name, upon which the Patent Office has recently acted favorably.

Reminiscences of Early Locomotive Work.

A representative of the AMERICAN MACHINIST, accompanied by a stenographic reporter, recently interviewed Mr. George Hollingsworth, of Paterson, N. J., one of the oldest engineers in the country, and obtained many interesting facts regarding the early history of the American locomotive, also curious reminiscences of early railroad operating. Mr. Hollingsworth began running on the Paterson and Hudson River Railroad in 1838. This was the beginning of the New York, Lake Erie and Western Railroad, and was then open only between Jersey City and Paterson. The first sod of the road was cut by Governor Dickerson on the Fourth of July, 1832, and Mr. Whistler, a famous engineer of that time, was in charge of the work. Mr. Hollingsworth remained on the road till 1845, when he joined the Rogers Locomotive Works, where he was employed taking out new locomotives till about a year ago. During that period he has been in all parts of the globe where Rogers locomotives are at work.

RUNNING OVER SLAB RAILS.

Q.—What kind of a track had the road when you began to run on it?

A.—Slab rails. They were terribly uncomfortable rails to run on, especially during wet weather. The water would loosen the spikes so that there was continual danger of the slabs coming up. Several times I had the rails peel up round the wheel and come straight past my chin.

Q.—Did they cause many accidents?

A.—Yes, quite a good many. One day when I was running on the Paterson road, a strap rail went up through the bottom of a car and tore through a lady's dress, but it did not hurt her seriously. Many others were not so fortunate.

AN EARLY DAY COLLISON.

Q.—What arrangements were trains run on?

A.—Passenger trains were run on card time, but freight trains were run wild. A train was made up and started out when it was got ready. We had to look out for the safety of our trains. One day I had a collision with John Graham. He started from Paterson about the time I started from Jersey City and we met half a mile beyond Passaic bridge, out in the woods. There was little damage done. John jumped over a fence and broke his shoulder-blade. I have only been in two collisions in my life, and I have been all over the country. I have never had my engine disabled so I could not get home, and I never hurt but one man.

ANCIENT METHOD OF CARRYING A POLITICAL MEETING.

Q.—How did that happen?

A.—It was taking out a train with a delegation to a political meeting near Paterson. That was a Clay meeting, and the road master, Van Bossmere, was opposed to it. He took up nearly a quarter of a mile of the track, and did not send out any one to flag the train. So I ran into the break. A man who was standing on the front car platform got his leg broke.

EARLY LOCOMOTIVES.

Q.—What kind of engines had you at first?

A.—On the meadows between Jersey City and Paterson we had four Baltimore engines; they were Ross Winans grasshoppers.

There were two others, one built at Lowell, and the other by Stephenson in 1832.

Q.—How did you like the grasshopper engines?

A.—I did not like them at all. Never worked such uncomfortable engines. They had no cabs at first. Then a kind of house was put up to protect us from the weather, and we had a square open hole to look through. Then they were an awkward engine to make and keep up.

Q.—What style were your English engines?

A.—They were of the John Bull type. All the boilers that were built in England for the Camden & Amboy folks were built very nearly after that pattern. They were built with a waist straight to the back of the furnace. The engines were all inside connected, but they were good running engines. They were bad engines to work though, for they were hard to reverse. They were built with a rock-shaft right in front of the cylinders, and the drop hooks came right through to where the shaft was and there was nothing to catch but the straight hook and die. So when the engine was running you could not reverse them. The V hook was a little better in this respect, and a figure 8 hook was better still.

But the link was what ended the trouble in reversing. These early engines did good work for their size. The parts were made in England and sent over here to be put together. Isaac Dripps put up the principal portion of them.

FIRST EIGHT-WHEEL ENGINES.

Q.—What kind of engines were the Rogers Works building when you knew them first?

A.—They were small inside connected engines with one pair of drivers and a four-wheel truck. They built very few of them. Mr. Rogers went to England on a visit, and when he came back they began building eight-wheelers, with two pairs of drivers connected. The first engines of this kind had the main rod connected to the crank-pin outside the back drivers. They were outside connected engines. Mr. Rogers was one of the first to advocate outside connected locomotives.

INTRODUCTION OF THE PETTICOAT PIPE.

Q.—Had these engines long exhaust pipes?

A.—Yes, the long exhaust pipe was used for several years; then, I think, old Jim Parks proposed the short exhaust pipe. He was a coal-pit engineer. When they tried the short exhaust pipe first it did not do. The steam spread before it reached the smoke stack and caused back lash. Then they put in the petticoat pipe, and that made the short exhaust pipe work all right.

STEAM GAUGES.

Q.—Had you any steam gauges in those days?

A.—No; we had nothing but the spring balance connected with the end of the safety-valve lever. They were Salter balance springs imported from England. Then Orton, of Elm street, New York, who was a pupil of Salter's, began making these spring gauges, and he got all the trade.

FIRST TEN-WHEEL LOCOMOTIVES.

Q.—Do you remember when the first ten-wheel engine was built in Paterson?

A.—Yes; I brought the order from Cuba for the first ten-wheel locomotive ever built by the Rogers Works. I had taken out some eight-wheel engines to a railroad in Cuba, and they had great trouble with slipping, owing to the sugar getting on the rails. They gave me an order for a ten-wheel engine, because they thought it would do better. They had never seen such an engine, but they seemed to think that ten or twenty wheels could be put under an engine if necessary.

FIRST ENGINE WITH MAIN ROD CONNECTIONS OUTSIDE OF PARALLEL RODS.

Q.—What did Mr. Rogers think about the order?

A.—He said he would build them what they wanted. One day he called me into the drawing-room and showed me the design of an inside connected ten-wheel engine, and asked me if that would do for Cuba. I answered, "No, Mr. Rogers, that will not do at all." Said he, "Why; what's the matter with it?" "Well," I answered, "how long would that crank-shaft last in the Island of Cuba with so much slipping?" Said he, "It might last for six years, and it might break in six months." "Now," said I, "when this shaft breaks out there, who is on the Island that can put in a new crank-shaft? It takes a good railroad mechanic to do that—a man who has got good ideas of machinery—to put that crank-shaft in and make it true. It would have to be done with keys. And, another thing, if it breaks, how long will it take them to send here for a crank-shaft and get it back there and on to the engine?" He scratched his head, and said, "Yes, there's something in that." He started out again, and then hit upon the present mode of putting the main connection ontside of the parallel rod. He told me afterwards that he had lost a good deal of sleep thinking over the matter. The only objection raised to this design was that the connection was too far from the wheel, and it might be apt to snap off the pin; but it worked all right. Two engines, the El Para and the Carara, were built after this design, and they were the first ten-wheel engines built at Paterson.

Q.—When did you first meet with expansion gear?

A.—About the time I joined the works the old man got out an independent cut-off that worked in connection with the cross-head. The steam chest was divided into two apartments by a horizontal plate which had steam ports through the middle, and the cut-off valve worked on top.

Q.—Did that rig work well?

A.—It saved wood, but it was a little complicated. An improvement on that was made a year or two later, when a cut-off was put on working on top of the main valve and operated by a separate eccentric. The one valve working on top of the other did not answer well, and was afterwards abandoned for the partition plate, but the separate eccentric to work the cut-off valve was retained. This was our common valve motion till the link was introduced.

Dean Brothers' Steam Pump.

The accompanying engraving shows, in section, one style of steam pump, as made by Dean Brothers' Steam Pump Works, Indianapolis, Ind. The construction is such that it will always go when steam is admitted, as it cannot stop when the main valve passes the center. The parts are well proportioned, and the design simple, embracing the latest improvements in steam-pump construction. The main steam valve is of the ordinary flat *D* form, believed by the builders to be the best for running and keeping tight.

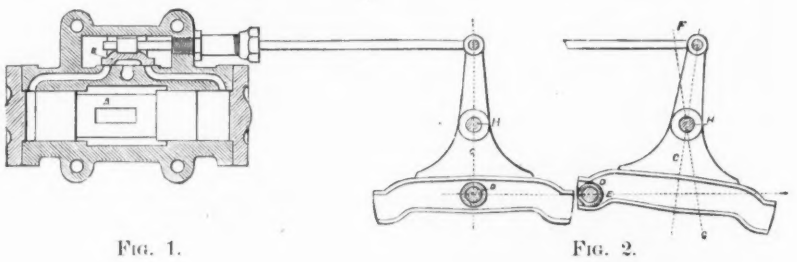
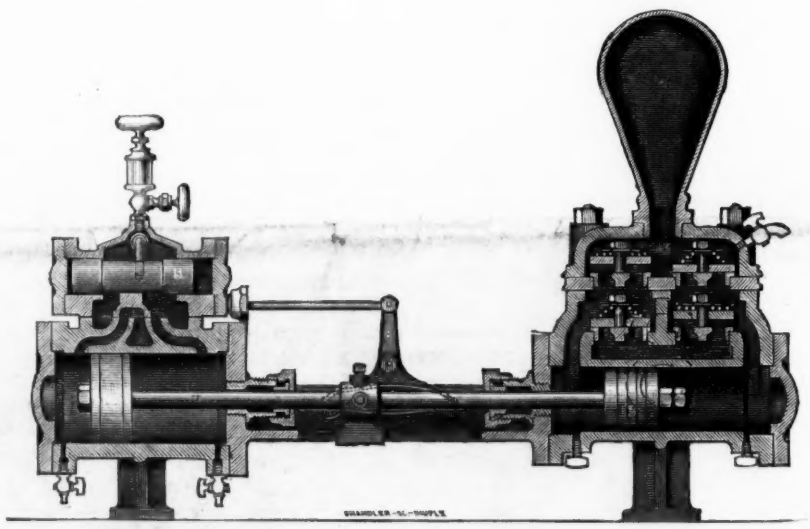


Fig. 1.

Fig. 2.



Dean Brothers' Steam Pump.

Figs. 1 and 2 illustrate the manner of giving motion to the main valve. The steam chest, for the purpose of illustration, is given a quarter turn, in order to show valve and ports in the same plane with the cam-lever *C*.

The chest piston, *A*, has a rectangular slot in its center, into which a lug on the main valve fits so that they move back and forth together. The cam-lever, *C*, rocks on the stud, *H*, and gives motion to the auxiliary valve, *B*. Fixed to the piston-rod of the pump is a cross-head, which carries the stud and roller, *D*. When the main piston moves from right to left, and as it nears the limit of stroke, roller *D* presses against the upper flange of the cam-lever, causing it to tilt, as shown in Fig. 2, moving valve *B*, admitting steam to the left of the chest-piston *A*, forcing it from left to right, and reversing the motion of the main piston. The roller *D* (Fig. 2) will then press against the flange *E*, of cam-lever, throwing it back to the position shown in Fig. 1. Valve *B* is made with considerable lap, so as to effectually close its ports when at mid-stroke.

From the foregoing it will be seen that the ports leading to chest-piston *A* are kept closed, except at the moment the main piston is being reversed. If the chest-piston *A* becomes worn there can be no waste of steam, as there is no place for it to escape. This is an important feature, as it provides against the waste of steam and poor working incident to the chest-pistons of direct-acting steam pumps becoming worn, and allowing steam to blow through to the exhaust. There is but liitle pressure on roller when operating the cam-lever, and the entire action of the pump is smooth and quiet. Over two thousand steam pumps, we are told, are running with this valve gear.

Q.—The cylinders must have been well spread for the early methods of fastening?

A.—Yes; but they were well fastened. The frame was heavy, and they were notched into it and wedged in place. Instead of fastening the cylinders to a saddle, as we now do, these were fastened to the smoke-box, which was made of double sheet. They held all right, and some of the engines are running yet.

Q.—Did these engines overcome the difficulty with molasses on the rails?

A.—They did better than the eight-wheel engines, and they were equipped with large, square sand-boxes. They also had water-tanks on the front end, that ran water on the rails by means of pipes, to wash them.

FIRST SAND-BOXES ON BOILERS.

Q.—Were these the first engines fitted with sand-boxes on the boilers?

A.—No; other engines had got round sand-boxes a little before this time. The first sand-boxes were put on the boilers about 1845.

CHANGES OF THE VALVE MOTION.

Q.—What valve motion was in use when you began railroad work?

A.—The drop hook was used entirely till about the time I went to Rogers, when the V hook began to appear.

Q.—Do you remember of any experimental valve motions being tried on locomotives, such as the Corliss?

A.—No. Nothing but what was connected with the different kinds of hooks and links.

The New England Manufacturers' and Mechanics' Fair, at Boston.

It is a matter of considerable curiosity to note the different purposes for which people are led to visit an exhibition of the character of this one. To one of an observing turn the careless criticism of the mechanic, who contrives to find out a good deal about the quality and workmanship of a machine by the turn of a handle, a glance at the corners, or the shake of a screw, betrays his identity beyond reasonable doubt. This class of visitors stop to examine a modest exhibit, which the great army of circular hunters pass by without notice. It consists of seven bevel gears from (about) 12″ to 4″ diameter, and of pitches (approximately) from $\frac{7}{16}$″ to 1″. These gears are mounted on shafts and continuously connected, so as to be put in motion by means ot a hand-wheel on the end of one of the shafts. In the largest wheel, of 43 teeth, two wheels gear—one a 12-tooth pinion gearing at right angles and the other a 31-tooth wheel—the axis of the latter being at an obtuse angle with the axis of the large wheel. The direction of the line of gears is such that it returns, ending nearly where it starts, the beginning and end, if these terms are applicable, being each provided with a hand-wheel. The features of this gearing that, aside from its smooth running, attract attention, are the almost perfect bearing of the teeth upon each other, as shown by their brightened appearance from the many turns they get, and the fact constantly being demonstrated, with one hand on each hand-wheel, that the total back-lash of the entire train is substantially nothing. This exhibit is by Brehmer Bros., Philadelphia, the gears being cut by a new special machine designed for this class of work.

The Star Tool Company, Providence, R. I., exhibit, amongst other machine tools, a new one more especially designed for grinding screw tools, or other tools that require to be ground to definite angles. The tool to be ground is held quite similar to a tool in a lathe. The head in which the tool is held can be swung around at any angle through the entire circle, it being only necessary to pull back a latch held in position in either of the graduated notches in the disk at the upper part of the head, and revolve the head to the desired angle, indicated by the figures, when by releasing the latch a spring forces it into the notch, locking the head in the desired position. The grinding wheel has a raised portion on each side, extending from the periphery towards the center for a distance of one inch to one and a half inch. The side or angle of the tool that is being ground is passed entirely across this raised portion, insuring accuracy. One side of the tool having been ground to the proper angle, the head is swung around in the other direction to the corresponding angular position, and the grinding completed, unless the tool is for a flat-bottomed thread, in which case the head is placed at the zero mark, and the requisite amount ground off the point by passing it across the face of the wheel. In addition to swinging around for the angle of the tool, the head can be tilted in either direction to grind any amount of clearance desired. The head in which the tool is held can be quickly removed and a holder substituted, by means of which twist drills may be ground. On the opposite end of the arbor a plain wheel is mounted for general tool grinding.

But few machine tools at the fair are shown in operation, which, especially in the

instance of tools possessing novel or valuable features, is a mistake. There would be but little interest in steam engines if they were not in motion, and there is always an interest in tools that are in operation. Nothing would do more to attract an audience than the announcement that the machine tools shown would be seen cutting metals. It would also serve to diffuse useful knowledge, as it may be presumed that only the best form of cutting tools would be used—at least the best in the judgment of the exhibitors—and visitors might, while studying the qualities of the various machines, learn something to their advantage in the way of cutting tools and coarse feed. The Star Tool Company occasionally show one of their cutting-off tools cutting up a $2\frac{3}{4}''$ steel shaft into pieces about as thick as a washer—a thin one—and the Hendey Machine Company, Torrington, Conn., exhibit one of their shaping machines—not a large machine either—taking about a $\frac{5}{8}''$ cut on cast iron, with a good coarse feed in operation. This machine attracts attention, not only from the heavy cut it takes so easily, but from the smoothness with which the friction wheels by which the ram is driven operate. The Hendey Machine Company exhibit a planer driven by the same arrangement of friction wheels; also a pair of very neat "pony" planers for the use of jewelers and amateurs. The Rochester Machine Tool Company show a planer in motion, with return speed three to one. The exhibit of enameled water-line glasses, noticed last week, should have been credited to Tomey & Sons, Lynn, Mass.

A Lively Exhibitor.

At this season of year, when judges of industrial exhibitions are laboring hard to deserve the honors conferred upon them by their appointment, by trying to allay the strong resentment of every exhibitor, who thinks he deserves a medal and don't get one, the following pleasant little episode, from the *Detroit Free Press*, will serve to interest them (the judges):

In the early days of Michigan, when a county fair was to be remembered, one of the Southern counties in Michigan held a fair one Fall, at which one of the exhibitors was a man named Prother. He had an entry of poultry, another of cattle, and a third of vegetables. When the judges on poultry came around, Prother met them with:

"Gentlemen, here are the biggest hens, the fattest geese, and the heaviest turkeys in this State. I want first premium."

"We'll see about it," replied one.

"I want the first premium or I'll lick the three of you half to death!" announced Prother in a strictly business tone, and it may be said right here that he didn't get the premium, and that he kept his word. Two of the judges were battered until they couldn't see, and the third got away after having two teeth knocked out.

When the judges on cattle came around, they turned up their noses at Prother's old cow and two half-starved calves, but he placidly remarked:

"Gentlemen, that 'ere cow was driven 480 miles to reach this State, and them calves can't be beat for blood. Their grandmother was owned by the Empress of France."

Something was said about his carelessness in not entering his stock for the bone-yard instead of the fair, and he answered with:

"Gentlemen, I'm willing to take second premium, and if I don't get it you'd better hire some one to hold me!"

They neglected his advice, and in due course of time had their noses driven back or their eyes put in mourning. Prother was telling the judges on vegetables what they might expect in case he did not secure a premium, when he was arrested, but only after he had pounded two constables. Within three weeks after the fair he had mauled the president, run the secretary into the woods, and pulverized the treasurer, and before the end of six months he had licked all the judges but two, and was hunting for them with great energy when he got before the courts and was sent to jail for a year.

The above sketch may be considered rather strongly drawn, but in one respect it is very mild. The judges who offended the irate exhibitor got through with their punishment three weeks after the fair closed. Frequently—quite frequently—the judges of an industrial exhibition are made to feel the wrath of disappointed medal-seekers three years from the time the show closes, and sometimes they may count themselves lucky to escape further punishment after that period. Fisticuffs hardly ever enter into the settlement of the grievance, but some judges who have had their business permanently injured by disappointed exhibitors, if they were again obliged to undergo a similar experience, would choose to be "battered" rather than submit to the other infliction. There may be some redeeming features about the system of awarding medals and prizes at exhibitions, but we have never discovered what they are.

Extracts from Chordal's Letters.

HOLDING TO OLD RICKETTY MACHINERY—EFFECT OF ABANDONING THE PRACTICE OF REBUILDING LOCOMOTIVES—ECONOMY OF THROWING OUT OLD MACHINES—GOOD AND BAD REPAIRS—BLOWING SAND OUT OF STEAM PORTS BEFORE CLOSING UP CYLINDER—DEFECTS OF STEAMBOAT BOILER INSPECTION—A REMEDY SUGGESTED.

Mr. Editor:

* * * It has always been a hobby of mine that machine men should get into the habit of looking at more things as articles of consumption. I never go into a shop having a lot of old-style chain-feed, upside-down V, straddle-bug tail-stock lathes, but what I think it would be good fortune if something would happen which would place the machines beyond repair. If you find a shop with one such tool in it, you generally find the shop stocked with them, and you will generally find the proprietor of the shop an elderly man who remembers what these tools have done. Let this man lead you through the shop, and as you pass the most reprehensible tool, he will invariably stop you at it and begin to speak in its praise, of the good work that it has done and of the amount of money which it has made. This love of the past may be all right, but is it good policy? These tools have been growing old and useless day by day, and, as a consequence, their ageing does not strike the owner who sees them daily. It is the keen eye detecting the departure of greatness that sees the way to present usefulness.

* * * I have always thought, and I believe I have spoken of the subject in these letters before, that machinists working at a lathe should have not quite so much love for the old four-inch scale, with its rust, and its dents, and its figures half gone, and its corners rounded. Instead of keeping this old scale for the good that it has done, it is better to throw it away for the good that it has done, and get a new one for future good doing.

* * * In a history of the Pennsylvania Railroad Company I notice the following, which has a bearing upon this subject of being willing to call old things old. "The Pennsylvania Railroad Company has abandoned for several years the very general practice of rebuilding locomotives; that is, of reconstructing them on an altered plan, and retaining a portion of the old boiler and machinery, and replacing worn-out parts with new. Since this practice was abandoned, and the old engines thrown bodily into the scrap-heap, new ones built on uniform plans, taking their places, the cost of repairs per mile run has decreased from $12\frac{21}{100}$ cents in 1866, to $8\frac{16}{100}$ cents in 1872, and this notwithstanding the fact that the load of the engines during the same time has been very much increased. This result is the more remarkable as all the new engines built to replace old ones have been charged to repairs."

* * * If we can know the relative productive capacity of an old machine when repaired, and also of a new machine, we may then ascertain how far it will pay to carry out this idea of throwing the old thing away, and we may also ascertain exactly when to throw it away. Facts are sometimes borne out by figures which, at first glance, appear unfavorable. I have in my mind, vaguely as to the actual figures, the matter of pavements under consideration by the Board of Public Works, of Chicago. One pavement was to cost so much per running foot, and was guaranteed to last for fifty years. Another pavement was offered at a certain sum, very much lower, and guaranteed to last five years. Without the actual figures I cannot give this example the appearance it ought to have, which was that the fifty-year pavement should be chosen by all means. Very little figuring, however, showed that the five-year pavement was very much the more economical of the two.

* * * It is astonishing what a difference there is in the two repair systems in different shops. I know some shops in which each repair upon a tool not only makes good the damage, but really makes the thing better and nicer. In other words, the repairs call for a better class of workmanship and a better class of material than was originally in the tool. In other shops repairs consist of mere makeshifts to bridge a gap.

Not long ago I was in one of the finest shops in the country—by finest I mean of the best reputation and doing most excellent work—and I noticed an 18-inch lathe of the weighted carriage persuasion, with an elevating screw at the tail of the carriage. This screw had the usual elated crank, and this crank had gotten the usual knock from some job rolling backward out of the lathe. I say this crank, but I mean the crank that was originally on the lathe. It had been replaced by a rough forging of the most awkward shape, not well fitted on its screw, and altogether as bad a looking thing as one might wish to escape from seeing. It was the more noticeable, as the old handle, which was an excellent job, had been put into the new crank. Here was a shop capable of doing as fine work as any on that lathe, and a shop with a general pride in things, and still that crank was just about as bad as their capabilities would possibly permit them to make. The sight of this crank led me to look for similar things, and I found, invariably, repair pieces of raw construction, badly fitted, and with no finish. It seemed as though the shop did good work only on those things which they expected to sell. In short, they were willing to buy a class of work themselves, of themselves, which they would not be so unreasonable as to except anybody else to buy of them. I must not here neglect to state that, in my opinion, if the crank on this lathe had been intended for a finished crank instead of an ugly forging, it would have fitted better on its screw. Good finish never goes with bad fits.

* * * An engine-builder with really good sense will be very careful to blow all the sand out of his steam ports before he closes the cylinder up—and he won't do it with a blow-gun either, but will want a good live current of steam. This, of course, is most always done, but some makers totally neglect it, and leave in the steam ports all the sand they cannot dig out with a piece of wire. This reminds me of the practice of Huber, of Marion, Ohio, in building portable engines for farm use. He leaves the cylinder open and leaves the piston, the cross-head and connecting rod off, the valve motion being all coupled up. He raises sixty pounds of steam in the boiler, and takes hold of the crank pin by hand and spins it around for a while. This puts the valve motion through its paces, and does all the blowing that is necessary. The fact that a man can take hold of one of these square-collared crank pins with his hand, and turn the engine round, shows at once a pretty good class of workmanship for farm engines, and is also a fine commentary on the theory that upwards of a good many per cent. of the power of an engine is used up in moving its valve. I have been told that it is not until ninety pounds of steam is on that the thing begins to work hard, and at the same time the valve has none of the relieving advantages of the back pressure due to the contracted exhaust.

* * * Late developments in the case of the explosion of a steamboat boiler have a tendency to show that an engraved certificate of inspection is not always a safeguard against danger. It is reasonable to suppose that efficient inspection will detect dangers and suggest a safeguard, but the theory cannot, of course, make any provision for inefficient inspection. The question of test, as distinguished from inspection, invites scrutiny. When a boiler blows up there are always plenty of experts to figure on tensile strength and bursting pressure, and to show that the boiler cannot possibly sustain its pressure. But how is this to stand in the face of a positive fact that it did sustain the pressure? Once in a while we have experts swearing that a certain boiler would not stand a pressure of 100 pounds without rupture, and there is some man to step in and swear that there has been 150 pounds pressure on the boiler within a week. So far as rupture is concerned, aside from the effects of heat, I suppose that pressure is pressure, and in the case of the steamboat boiler which brings this subject to my mind, we have a certified hydrostatic test far above the pressure which evidently caused the rupture.

* * * I am no expert on the subject of steam boiler explosions, and I never have been around when one happened, but if any boiler is bound to blow up when I am present I have an earnest desire that it shall be some old boiler, not much thicker than stove-pipe iron. I would rather trust my life to the weak forces pent up in such boilers than to the immeasurable forces which proper strength is supposed to guard. This is presuming, of course, that there is a blow-up. If there is no blow-up, I do not care how thick or how thin the boiler is. If the blow-up is not a certain thing, but is a mere tendency, I think I would rather prefer the thick boiler. If a rope is bound to break, one need not care whether the rope is small or large; but it is well to look to the size of the rope before trusting life to its strength.

* * * It seems to me that our inspection law should be so modified as to require a descriptive roll of every boiler in use in the land—whether now in use or made in the future. This descriptive roll to be in duplicate, one copy at headquarters and the other copy on the boiler premises: the description to refer as minutely as possible to every detail of the boiler, its setting, its derangement, its cleaning, its usage, and the men in charge; and to bear a weekly log, under oath, showing any alterations, or repairs, or changes, or cleaning, or behavior. Transcripts of the log to be reported monthly by the Government officers to headquarters, to be attached to that copy of the roll. The effect sought in this is a moral one. A dangerous matter should be held in view by reasonable solemnity at reasonably short intervals, and a rigid inspection of the descriptive roll and a rigid insistance upon the solemnities might do as much good as the present system of inspecting the boiler, or pretending to inspect it, ouce a year, and doing all the solemn business under oath before the coroner. Let a printed statement containing fifty questions be intelligently filled out, under oath, each month, and we will know something about the everyday life of a boiler and something of the intelligence of the man in charge. Let it be a log for fair weather or for foul. There will be little satisfaction in reading the log of an exploded boiler over the bodies of its victims, but if the duty of writing the log would tend toward intelligent scrutiny and provision, it might possibly have no other function except to be written, and furnish an idea of the working situations of boilers generally.

Very respectfully,

CHORDAL.

Several times during the Summer items have found their way into the daily papers about a wooden boiler which a workman in Paterson had made, and was getting ready to supply steam for running a small pleasure boat. The boiler, which was made out of a beer cask, was ready for firing up the other day, and an experimental trip was made with the boat. The boiler was strongly hooped, and stood a pressure of 80 lbs. to the square inch without leaking. After the trip the boiler-maker and owner tied the boat to the wharf and went home. About half an hour afterwards the boiler exploded with such violence that what was left of the boat would not pay for a new beer cask properly set and piped. When that Paterson man wants another wooden steam generator strong enough to stand the required pressure he should investigate the merits of a "Jersey lightning" cask.

More Criticism of Machine Tools.

By Oberlin Smith.

Having in several former articles criticized at considerable length the design of the best modern types of what may be termed the major machine tools—lathes, planers and drill presses—I will here more briefly refer to the less common tools, such as boring mills, shapers, slotters, milling machines, gear-cutters, etc. These machines are all of more recent invention than those first named, and perhaps to this fact is due their superiority, there being no foolish precedents to follow, as is particularly the case in regard to lathes. Before specifying in detail the points in these machines needing reform, it may be well to say of them collectively that they all need about twice as much cast iron in their constitution as is at present used. The object of this tonic dose is to secure increased inertia, rather than mere strength. A part of this metal can, however, be well used in increasing the size of shafts and slides, and the length of the bearings thereof.

Going more into detail, and speaking first of upright boring mills, we find that they have been brought to a wonderful state of perfection (using the word perfection in a relative sense only), and many of them are capable of doing excellent work at a very rapid rate. They usually, however, have one grave fault, viz., slimness of the posts sideways—precisely as is the case with planer posts, described in the article on "planers," published in these columns several weeks ago. This is a fault which it is obviously easy to remedy by proper "bracing" in the post castings.

Horizontal boring machines are quite a different style of tool from the above, and resemble lathes more nearly, in various points, than any other family type. As produced by the best makers, they are capable of excellent work. Being used mostly for small diameters, they are usually sufficiently strong and powerful for their duty. The weak point in operation, as in all boring machinery, lies in the boring bars themselves, and about these a whole treatise might be written without devising a cure for their inherent depravity.

Of radial drills, so-called, much might be said, but chiefly of the same tenor and effect as was said of drill presses in a recent article in this series. Their principal need (besides greater weight all over) is a much increased diameter, with consequent stiffness in the main column and greater depth in the radial arm. Of the two styles of these machines—those in which the arm and appurtenances adjusts up and down upon the column, as well as revolves about it as an axis, and that style in which the arm revolves only—the former are much to be preferred, just as are the drill presses with a rising and falling "head." Some of the radial drills have mounted upon their bed-plates a large cubical block or box into all sides of which T-slots are sunk, and which is provided with (as an attachment) a slotted table hung upon an axis, and adjustable to any angle, with the horizontal, measurable by an index. This arrangement is very convenient, and is indispensable in a really good machine.

Shapers and slotters are both, of course, modifications of a planer, yet their construction and action is usually very different. There are in the market all grades and qualities, almost as much so as with lathes and planers; but those produced by the best makers have been carefully studied out in almost every detail. Their accuracy of adjustment and the beautiful devices used for the "quick return" are worthy of all praise. With somewhat more weight of metal and greater stiffness in some of their members—notably the "ram"—the best of them would be capable of doing excellent work. A minor fault with many of them is the lack of a sufficiently coarse feed for flat "finishing cuts." A generic fault in all, or nearly all, of these machines, affecting, however, the speed rather than the quality of the work, is the necessity of stopping to adjust the length of stroke and the position of the ram. I know of but one crank machine which attempts to obviate both of these difficulties, and it has not yet reached perfection, though it is a step in the right direction. It is a shaper, made in Newark, N. J., and has an ingenious arrangement for altering the length of the crank while the same is in motion. The position of the ram can be changed by an expert operator by a happy-go-lucky, catch-'em-if-you-can, seize-the-golden-moments-as-they-fly sort of a movement—the handle nut upon the bolt which locks the ram to its driving mechanism below being upon the top of everything, and in such a position that a false movement will not endanger thumbs and knuckles. This latter feature might with advantage be imitated in some of the other makes, whose thumb-mashing capabilities, even when not in motion, must aid considerably in charging up little items in the "swear-book" of any machine shop. There are friction-driven shapers now made whose rams can be set anywhere while running, by "dogs," the same as in a planer. Though very convenient to adjust, they have not the positive driving action nor the accurate stopping points that are such valuable features in the crank machines.

Of milling machines there needs here but little be said in the way of criticism. They have been chiefly built by a few specialists, who have developed them to the highest degree of refinement. The very fact that they have been improved up to the requirements of the sewing machine and gun factories, whose processes must be both accurate and rapid, and that they are not so much the creatures of foolish precedent as are the more common machine tools, built by every Thomas, William and Henry who has a little machine shop, will account for their high state of perfection. This critic will, of course, say that they ought to have double the metal in them that they now have, and that there ought to be some uniform standards for sizes of "arbors," so that milling cutters would be more interchangeable among different makes of machines.

Gear cutters, though only a specialized form of milling machine, are older than the apparently parental stock. They are, on an average, meaner, although there are at the present day some very excellent (if they were only heavier) ones in the market. Aside from the peccadillo of not having a standard size for these arbors to fit a standard series of cutters (which doesn't yet exist), these machines all, good and bad, have one glaring fault, viz., a small and practically solid spindle, with very flimsy and inadequate means of attaching the work thereto. The makers of these tools seem to assume that the only work to be put in them consists of the conventional gear-wheel—a thin, flat disk, pierced by a small parallel hole. Into this hole is to be driven, nearly to a bursting fit, a home-made mandrel, the other end of which is driven into a small tapering hole in the (middle of?) spindle, very much after the manner of a lathe center. When the user gets enough hundreds of these mandrels made for all possible or probable sizes of holes, he can, with the aid of a hammer and several pieces of old copper, manage to cut ordinary gears, especially if he wants to kill a little time in getting them on and off.

Now, it is obvious that to cut a true gear the mandrel on which it is placed should not only be laterally stiff, but should be firmly secured against the work slipping in a rotary direction, and thus nullifying the value of the accurate indexing, which is the vital point of every gear cutter. To prevent this rotating, the mandrel should, of course, be secured to the spindle by a "feather" or other device. For the same reason, and also that work may be rapidly changed, the mandrel should be tapered at the outer end and provided with split, internally-tapered sleeves, which outside approximately fit the holes in the gears to be cut. The latter can be slipped easily on to the sleeves, which can then be expanded to any required degree by forcing them endwise with a nut upon the outer end of the mandrel. This arrangement makes a good fit in the work, even when the holes, nominally the same, vary slightly in diameter. For very small holes a mandrel with nut and flanges, such as are used to hold emery wheels, may be substituted, if desired. There is evidently no object in having the inner end of the mandrel small, as in cases where the holes in work are large it will be weaker than need be and liable to undue lateral deflection, especially when subject to the leverage of gears of large diameter. Hence, we reason that the socket in the spindle should be very much larger than now made—say, 100 per cent. or more. Of course, the outside of the spindle must be enlarged to suit.

A good practical method of construction would be, as it can be quite short, to make it a part of the same casting as the index wheel, and let the socket be a large hole continued entirely through.

There is another most excellent reason for this hollow spindle construction, which is that it is frequently desirable to forge or cast a gear in one piece with its shaft, as shown at *a*, *b* or *c*, Figs. 1, 2 and 3. The shaft could be slipped inside of the hollow spindle, which, by the way, should be screwed, like a lathe spindle, to receive a chuck. The class of

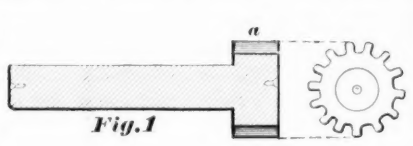


Fig. 1

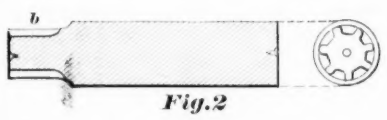


Fig. 2

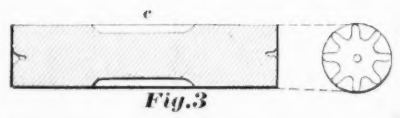


Fig. 3

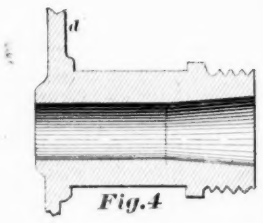


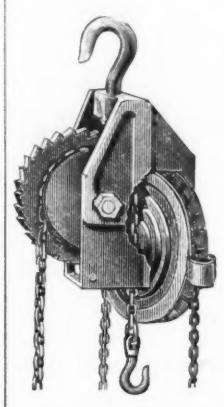
Fig. 4

work above mentioned could be held securely by a "universal" or other special form of chuck. In many cases it could be gripped by exteriorly tapered split sleeves, placed around it and forced into the taper socket in outer end of spindle. Such a spindle, with part of the index wheel *d* broken away, is shown in section in Fig. 4. A good gear-cutter should also be provided with a device resembling a "steady rest," not only to support the outer end of such shafts as Fig. 3, but to steady a specially elongated mandrel, to be used in gears with exceptionally broad face (long teeth), or gears which are thrown a long way forward of the spindle by an extra long hub or by "dished spokes." It may be remarked that the above-mentioned devices are not fancy sketches, but arrangements which the writer found necessary as modifications of a "bought" gear-cutter.

In concluding this somewhat disconnected series of articles upon needed reforms in machine tools, I will not linger upon various semi-special tools about which much might be written. Of the common tools not yet touched upon, I might say of screwing machines that they are very good (some of them), and probably as good as we can expect for using with our present systems of screwing dies. In the various forms of grinding machinery (not most of it conventionally to be classed with "machine tools"), there is so much reform and invention needed as to require a special treatment. The same thing may be said of another important class of machinery which is coming more into use every day in our machine shops, viz., punching machinery.

Batt's Portable Hoist.

We hereby illustrate a new patented invention which is likely to come in competition with the differential pulleys and chains for hoisting purposes. This hoist consists of two wheels mounted on a malleable-iron frame, which holds them in position and carries the load when the hoist is at work. Two wheels are placed in the frame at right angles to each other, the axis of one wheel being nearly in line with the periphery of the other. The upper wheel has ratchet-like teeth round its rim, which engage with a spiral screw on the side of the connecting wheel. When the chain on this wheel is operated, it turns the ratchet wheel, which has a lifting chain pocket disk attached to its side working on the same vertical plane.



When the chain on this hand-wheel is drawn round, it turns the ratchet wheel the distance of one tooth for each turn of the spiral. On the side of the ratchet wheel is attached a pocket disk for operating the lifting chain. As the load is drawn up the chain locks itself, for the ratchet teeth cannot impart motion through the spiral to the other wheel. The hoist is compact and likely to prove durable. It is manufactured by Charles F. Batt, Phœnixville, Pa.

The Pennsylvania Steel Company, Steelton, Pa., has recently made what is claimed to be the largest run of steel on record. In twenty-four hours they ran 164 heats, turning out 2,952 rails, making an average of 2½ rails per minute for the whole time. So says the Pittsburgh *Commercial Gazette*.

Rival for the Locomotive.

The Daft Electric Works at Greenville, N. J., are experimenting with electric motors with the view of bringing them more extensively into use as means of transmitting power. They have a saw-mill going worked by electricity, and two railroads are used for experimenting with electric locomotives. The parties interested in the works have great confidence in the future of electricity. In an interview with a reporter of a daily paper, the head of the firm said that by their system they could operate railroads with less than half the present cost of fuel. And electricity would be unlimited in speed. The best locomotives on the Pennsylvania Railroad consume 8½ tons of coal per horse-power per hour, while their compound stationary engines could be run for two tons of coal per horse-power per hour. As to speed, they had a motor that could run 70 miles an hour, and he expected it could be increased to 100 miles. In this interview either the electrician or the reporter blundered badly over the coal bill. If the reporter took tons instead of pounds, his informant, by ignorance or design, was slandering the Pennsylvania locomotives. They do not burn more than half of 8½ pounds an hour per indicated horse-power.

It is one of the characteristics of promoters of new schemes to be sanguine of overwhelming success, but nothing that the Daft or any other electric motor has yet actually done promises to eclipse the steam locomotive in point of economy. At present the best performance of electric motors is to transmit about 30 per cent. of the power expended. As regards speed, the parties who talk about running 100 miles an hour generally overlook the fact that speed is obtained by power, which must be maintained to keep up the velocity. The question is not so much: Can you turn the wheels of a motor 1,800 times a minute? as it is: Can you apply power in that way to pull a train of 200 tons over a railroad

track at a speed of 100 miles an hour? There are a good many operations successful in a small scale that utterly fail when magnified one hundred-fold.

The Stearns Manufacturing Company's Slide-Valve Engine.

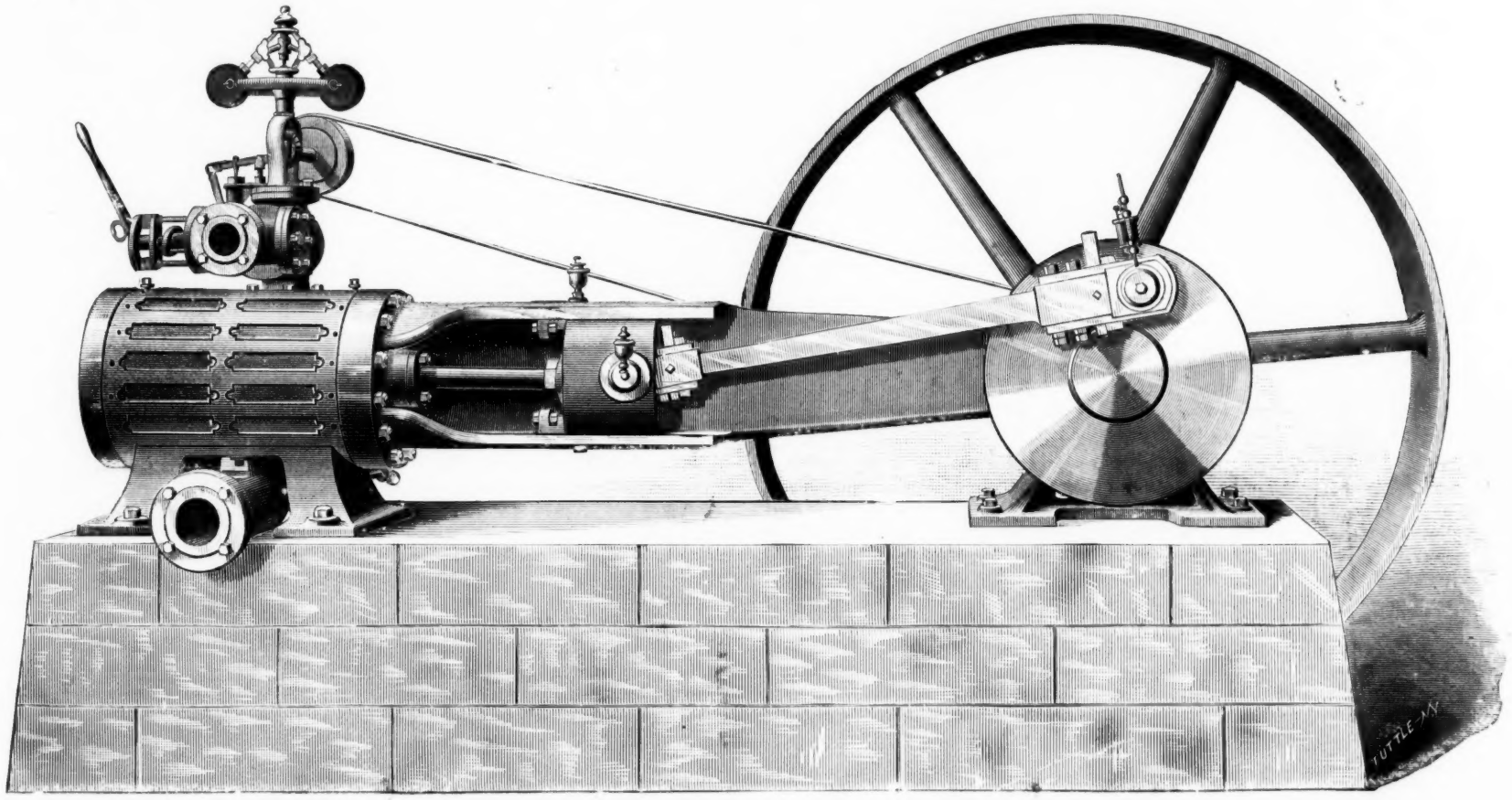
We present with this an engraving of the slide-valve engine, built by the Stearns Manufacturing Company, Erie, Pa. In the design and construction of this engine it is assumed that a slide-valve engine constructed with the same care and attention to detail that is used in the instance of the automatic cut-off engine has an economic value, and that much of the failure of slide-valve engines is attributable to lack of attention in these respects. Hence the details of these engines are made to correspond with modern practice in the construction of the better class of engines.

The engraving represents a 16″x30″ engine, but the different sizes built by this company, from 10″x16″ up to 30″x42″, are made on the same general plan and substantially the same proportion of details. The valves are scraped and fitted while hot, and for the larger sizes the valve is balanced by the use of a pressure-plate, fitted like the valve to the seat, while hot.

The crank-shaft is made about one-half the diameter of the cylinder, and is of hammered iron. The crank-pin is in diameter one-quarter that of the cylinder.

Quarter boxes are provided for the main bearings, which are filled with the best babbitt metal.

The cross-head is fitted with gibs adjusted by wedges, and the connecting-rod is of the standard bolt and key type. A sensitive governor is used, and a convenient lever throttle valve. The cylinder is substantially lagged, and the engine presents a neat and finished appearance. The Dexter Engine Company, 46 Cortlandt Street, New York, are the Eastern agents for the sale of this engine.



The Stearns Manufacturing Company's Slide-Valve Engine.

The five trade societies of Great Britain, composed of machinists, boilermakers, and founders, numbered at the close of 1882 no less than 97,204 members. During the year 7,588 members were added. The income for 1882 was over a million dollars, and the balance in the treasury nearly a million and a half. The expenditures are about equally divided between out-of-work allowances and sick benefits. Out-of-work does not necessarily mean on strike, for during the last three years £490,931 were paid out for benevolent purposes, against only £12,328 for strikes.

Recollections of an Old Machinist.

Mr. John Robertson, the head of the firm of John Robertson & Co., Water street, Brooklyn, is of an old Scottish family, whose members have followed machinist and millwright business for several generations. By aid of his own and his father's reminiscences, Mr. Robertson knows mechanical traditions back for a whole century. He remembers seeing the steamer Comet on the Clyde, that having been the first steamboat used in Europe for practical commercial purposes. Mr. Robertson learned the machinist trade with his father, who was a tool-maker in Johnstone. In 1829 he went to Calcutta to fill the position of chief engineer of a large textile manufactory. Here he remained for nine years, then returned to his native town, and went into partnership with Mr. Shanks of Johnstone, father of the well-known tool-maker of that place. A year or two afterwards the partnership was dissolved, and Mr. Robertson came to America.

INVENTOR OF THE FIRST SLIDE-REST LATHES.

Among other interesting mechanical facts imparted to a representative of the American Machinist, Mr. Robertson said that the lathe slide-rest was invented by Henry Maudsley, a well-known machine maker of London. It will be remembered that James Nasmyth started out as an assistant to Maudsley. Henry Maudsley was a working machinist with Bramah, inventor of the hydrostatic press, which bears his name, and also inventor of many improvements on locks. At that time, the plunger of the hydrostatic press was packed with hemp held tight by a gland. The pressure could be applied all right, but it was next to impossible to release the tension. Henry Maudsley overcame this by inventing the leather collapsing packing.

While working on fine lock work, which was a specialty with his employer, Maudsley found difficulty in taking exact cuts on lathe work with the hand tool, which was then universally used. So he invented the slide-rest and tool-post. While yet a common workman, he began to turn his attention to uniformity of screws, and when he became a machine builder he introduced uniformity of sizes in all screws used, with interchangeability. His system was as complete as Whitworth's, which it antedated by many years.

For an ordinary workman to make a start as a maker on his own account, has always been a difficult matter in Britain. Maudsley wanted to get married, and to meet the expense of house-keeping he asked his employer for more pay, which was promptly refused. So he determined to take a wife and a shop of his own at the same time. He began in the humblest kind of way, doing all his own work. The finest kind of a screw he could make he exhibited in his window as a sign of what he could do.

About this time, the father of the famous engineer Brunel, who was also an engineer, had a contract from the government to construct a machine for making blocks for the royal navy. He needed some very accurate screws, and some one who had seen Maudsley's sign, mentioned it to Brunel. He found Maudsley and gave him odd jobs to do, which were so well executed that the young machinist soon came to be regarded as the proper man to employ on work needing close skill and accuracy. By this means Maudsley worked into government contracts, and his business grew and prospered. He built many of the finest marine engines constructed in the early part of this century.

International Patents.

In the United States a patent is granted for the full term of seventeen years, but with the invention patented abroad, this term will expire by limitation with the expiration of the corresponding foreign patent, and not only does it go to this extreme, but it expires with that of the shortest limitation.

There is no country in which a patent, if at all valuable, can be disposed of to better advantage than in our own, but the patent must be protected, if foreign applications are made, from being short-lived in consequence of neglect or ignorance on the part of the inventor or attorney making the several international applications.

If we cite the countries and their respective patent privileges, this trouble will be made clear to the reader. As already mentioned, the United States patent expires at the end of seventeen years. Section 4,887 of the Patent Laws says:

"No person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid by reason of its having been first patented or caused to be patented in a foreign country, unless the same has been introduced into public use in the United States for more than two years prior to the application. But every patent granted for an invention which has been previously patented in a foreign country, shall be so limited as to expire at the same time with the foreign patent, or if there be more than one, at the same time with the one having the shortest term, and in no case shall it be in force more than seventeen years."

The inventor must also be satisfied that the subject patented has not been patented or described in any printed publication in this or any foreign country before his invention or discovery took place.

In England the greatest life of a patent, except it be prolonged by a special decree of the Judicial Committee of the Privy Council, is fourteen years. This prolongation is occasionally granted where patents are shown to be of extra great utility, and it is decided that the inventor has not been sufficiently compensated. This gives the inventor generally a new ownership for a new half term of seven years, though in extreme cases the time is occasionally extended to an additional fourteen years.

The rule also prevails in England, and similarly in this country, that if the invention be clearly described in any printed book or specification in any public library within the United Kingdom before the date of application, the patent is void after proof. Also an English patent expires with any foreign patent of prior date for the same invention.

As a result of the English publication rule, it will be apparent to any inventor or applicant for an English patent, that the arrival of the Official Gazette of the United States Patent Office containing the allowance, number and claims to a patent in England at once kills all chance for obtaining said patent in the United Kingdom—or England, Scotland, Ireland and all the adjacent islands—and at once permits the use of such invention without let or hindrance.

The publication rule holds good throughout Europe except Turkey and Greece. In these two countries there is no rule at all concerning this particular feature. In France printed publication of patent in any country or its public use in France prior to the application makes void any patent after proof.

In Belgium the rule is still more stringent, the prior patenting or publishing in any country making a patent void on proof. Germany limits the application to a precedence of not having been worked in Germany or published in any printed book or paper before date of application for patent. The

Austrian rule is about the same as that of France. In Italy, prior publication or working invalidates a patent.

In Spain, covering Cuba, Porto Rico and the Philippine Islands, a prior publication or foreign patent of less than two years date antecedent limits the length of a patent to ten years duration.

In Russia, prior publication or working invalidates a patent. In Portugal, if the invention be worked or published in that country, before application, the patent is void.

Thus it is seen that the mere application or use of an invention in any one country, whether it be important or not, either limits the life of a patent or debars the inventor from such advantage and privilege in another.

Now, to examine into the chances of a patent, it may be assumed that an inventor is about to make application for patents in this country, where the term is limited (neither shorter nor longer) to 17 years; also in France, where the term is 15 years; in England, where the term is 14 years; in Germany, with 15 years, and in Belgium, with 20 years. The first duty of the applicant is to file his application for a patent in this country. Here it undergoes official investigation to determine its scope and keep it within reach of the present state of the art. The length of time between date of application and date of allowance cannot be determined, since certain lines of invention are more crowded and uncertain than others. With the application granted, however, the holder of the grant is entitled to a delay of six months from the date of allowance to the date of issue of the patent, of course risking the possibility of being anticipated in any foreign country. In the meantime he prepares the necessary applications for the other countries, ships them and has them ready for use in all the countries mentioned. On the day and date of the issue of the United States patents, these applications should be filed at the patent offices of the several countries named except Germany; this he may have filed one day ahead so as to reliably anticipate any possible chance of prior publication, and to save as much of the time allowed for the patent to run in each of the several countries. By this means, under ordinary experiences, all the applications will bear even date, and will not be anticipated by a patent in any foreign country. In only two countries, France and Belgium, is it necessary to be more particular than to strike an even date. In these countries the applications bear a stamped record of the exact moment of the filing of the same, and this record must anticipate the time of publication of the patent in the United States.

If, however, some mistake be made in the filing of the application, it is easily seen that trouble and loss will result. Thus, if the application for patent in France be deposited too late (and not even a day is necessary), the publication and issuing of the United States patent prior to said application make its allowance void on proof. Or, again, to reverse the order, if the patent in France anticipates the publication and issue of the patent in the United States, then is the life of the American patent shortened to the 15 year standard of French practice. So, also, if either the French, English, German or Belgium applications be filed, and a patent is issued holding an earlier date than the United States patent, then if the regulation fees or taxes are not paid in either of these countries, the patent becomes void in the United States, as also is the case in France and England if a patent becomes void in Germany or Belgium. In Germany and Belgium this rule does not hold, those patents not being dependent upon the life of patents in any other country.

To come nearer home, in Canada the life of a patent depends upon the amount of money paid at the time of application, the limits being 5, 10 and 15 years. The fees for additional periods of time may be paid up to the whole legal life of the patent, but if the original application be made only for the 5 or 10 years, whether the patent be extended by paying the fees or not, the United States patent expires with the original limit of the Canadian application or other foreign patent whose rules have a similar condition of advance payments. So it has been held by the United States courts, that although the foreign patent of prior issue is kept in force by paying extension fees, still this is not recognized as affecting the original standing of the patent in the United States; and that the United States patent lapses with the expiration of the original limit to the foreign lifetime of the same invention.—*Railway Review.*

Machinists' Wages Under Free Trade.

"The engineers in the Leeds district," says *The Engineer*, of Glasgow, "where the minimum weekly wage is at present twenty-six shillings, have resolved to demand an advance to a minimum of twenty-eight shillings. In the event of the advance being refused a strike is threatened, but it is hoped that the employers will, in the present state of trade, accede to the demand. There are about a thousand men in the district paid at less than twenty-eight shillings per week."

Six dollars and eighty cents a week would be considered a rather small minimum for machinists' pay in any part of our country, and we hope American machinists will never be obliged to come down to free trade and such compensation for their labor.

LETTERS FROM PRACTICAL MEN.

Twist Drills Fifty Years Ago—An Old Locomotive—Lathe Shears—The First Tool Rooms—New Way of Tightening Lathe Belts.

Editor American Machinist:

In your issue of May 19th you publish extracts from a paper read by B. Ford Smith, in regard to the use of twist drills in England. He says they were used in England thirty years ago. I think I can give a little unwritten history of the use of twist drills in America, which is nearly fifty years old.

In 1836, at the time Seth Boyden was building the locomotive "Orange," which was completed and delivered to the Morris and Essex Railroad, August, 1837, and run until 1863, he had in his employ, as blacksmith, Mr. Samuel D. Harris, Sr.; and, wishing to drill the stub ends of the rods for the Orange, he asked Mr. Harris if he could make a twist drill. He having, when a boy of fourteen years of age, seen auger bits twisted, replied that he could; and, being told to go ahead, selected a piece of steel, flattened it, and twisted it—holding it in a vise, and twisting a small portion at a time. The drill was turned to size, the grooves filed out, and it was used by our veteran machinist of this city, Cyrus Currier, of the firm of C. Currier & Sons, machinists.

Mr. Harris is still living, at the age of eighty-two years, hale and hearty, with all his faculties, and would not hesitate to take an hour or two behind the anvil if he had good eyesight. He lost an eye about forty years ago, by a sliver of steel, on account of a mis-blow by his helper. He is also the oldest and only living original japanner in this country.

The Orange was the first locomotive engine built in this State. It was the first outside-connected engine built, and had but one eccentric to each engine. When I was a schoolboy, the engine would at times stand on a side-track out of gear, and I would throw her valves by the rock-shaft, then get on and open the throttle and let her move a half-turn, not daring to hook her in for fear she would get away from me.

A word in regard to lathe shears. I say four V's for me. When an apprentice, I run a lathe with the tail stock on V's and with a fine point to the centers. I could set the lathe to turn parallel every time, by placing the centers to match. My experience with flat shears is, that it often takes as much time and patience to set a flat-sheared lathe to turn parallel as it ought to take to do a small job. This is caused by lost motion between the shears and tail stock, developed by sliding the tail stock on the shears. When the lathe is once set true, if the hold-down nuts are slacked up a half-turn and screwed down again, the lathe will not be parallel.

The question of the first tool-room has been agitated in your paper. The Newark Machine Company, which succeeded Mr. Boyden in the machine bnsiness, erected the building now occupied by the Domestic Sewing Machine Company as their wood-working department, in 1853, and occupied it in 1854. It was planned by the superintendent of the company, Mr. F. W. Howe. There was a tool-room on each floor.

Chordal seems to be well posted on shop kinks, but there is one kink I have never heard him speak of, and I do not think he has been there or he would have had something to say about it; that is, moving a lathe, to tighten the belt, to such a distance that the shipper can be handled better from the back than from the front side of the lathe, and a person walking by can run his head against the shipper (as I have done) if he is careful. Crank.

Newark, N. J.

Pivot Bearings for Vertical Shafts.

Editor American Machinist:

In your issue No. 40 information is asked concerning the pivot bearings of vertical shafts. As you say, "there is a wide diversity of practice," &c. Fairbairn, alluding to the long vertical driving shafts of cast iron, running on brass steps, which was the usual practice in English cotton mills, says "the pressure should never exceed 240 pounds per square inch, and even with this pressure it is difficult to keep the steps cool." The speed of the shaft is not considered. Trautwine says: "When the pressure on a pivot does not exceed 150 pounds per square inch for cast iron or 300 pounds for steel, with good lubrication it will revolve rapidly for a long time without sensible wear." Furthermore, that slowly revolving pivots, such as railroad turn-tables, will safely endure a pressure of half a ton, or even a ton, per square inch. As the frictional resistance of the pivot increases with the diameter, it is important to keep this dimension as small as possible.

I can give a few illustrations from current practice. Railroad swing bridges are in continuous use, whose pivots of chilled iron or hardened steel sustain a pressure of 7,000 pounds per square inch. The maximum velocity of the pivot averages about one revolution per minute. Under this pressure soft steel will cut and soon wear out. In fact, soft steel surfaces ought never to be used together in rubbing contact, as they are liable to cut under very moderate pressures.

With the vertical shaft of a squeezer (the ponderous machine used for preparing puddled iron for the rolls), hardened steel pivot plates of 4½ inches diameter in continuous use for 14 years, running about 120 hours each week, are still in good condition, the speed being ten revolutions per minute. The speed of the machine being increased to twelve revolutions, and the duty also increased, it was found necessary to increase the pivots to 6 inches diameter, which works satisfactorily. These steps sustain a load of 23,000 pounds, or for the 4½-inch pivots about 1,400 pounds per square inch. For the 6-inch pivots about 800 pounds per square inch. By a mistake soft steel step-plates were put in, which were destroyed in a few months.

In another case, a vertical shaft runs fifty revolutions per minute on a 4-inch hardened steel pivot, bearing a load of 5,300 pounds, or about 420 pounds per square inch. After five years' service, running 120 hours per week, the surfaces had worn about one-quarter of an inch.

In all cases, to obtain the best results use only the hardest metals for pivots. Chilled cast iron is the best, but not always as convenient of application as hardened steel. Arrange so that oil will be supplied at the center of pivot. No necessity for lateral channels; these only reduce the wearing surface, and the oil will find its way from the center outwards by centrifugal action. Under the above circumstances the fo'lowing rule may be used as a guide: Multiply the diameter of the pivot in inches by the number of revolutions per minute; divide this product into the number 70,000; the quotient will be the pounds per square inch which may be safely borne by the pivot.

This rule is entirely empirical, and has only a limited application, being based on the assumption that the pressure per square inch ought to be reduced proportionately to the increase of velocity, which is probably not the case. By this rule, your correspondent's 3-inch shaft, bearing 4,000 pounds, would require a 3-inch pivot if its speed was forty revolutions per minute; or, if its speed was 100 revolutions, the pivot ought to be 7 inches diameter.

Probably some of your readers can furnish interesting cognate examples from the behavior of thrust bearings on the shafts of screw propellers. J. C.

Pencoyd, Pa.

Boiler Explosions.

Editor American Machinist:

In a daily paper, which I read every evening, I find an account of a recent boiler explosion in Pittsburgh, the ending of which is as follows:

"No theory as to the cause of the explosion is advanced, the only person who might have unraveled the mystery having been killed instantly." In the column immediately preceding the one containing an account of the explosion, is an advertisement of a feed-water regulator, and low-water alarm, a very conspicuous part of which is worded as follows: "A permanent and reliable safeguard against steam boiler explosions, 90 per cent. of which are caused by low water." * * * *

I have never witnessed a boiler explosion and hope I never shall, unless I am informed of the impending catastrophe at least five minutes previous to the time of opening up. Yet, I believe that this 90 per cent. low-water idea is far from correct. Very often in case of a boiler explosion, when those who were near enough to know anything about the matter, are blown out of existence, the expressed opinion is: "Low water undoubtedly." I once examined the bottom of an upright bleaching tank, the shell of which had gone above the evening previous, at the same time diminishing the population by six. This explosion was not caused by low water; anyhow the steam was supplied to the tank from a boiler located fifty or sixty feet distant, and in another room. I recollect, however, that there was at that time low water in the river, which ran close by, but I do not think that that had anything to do with the explosion. Steam engines wear out; wagons wear out; even weather vanes and straight edges wear out, and it is only just to assume that steam boilers wear out also.

It would be a saving of life, I think, to oblige everybody to know that steam boilers wear out; that their strength continually decreases. Every day a boiler is used it becomes weaker than the day before. Boilers should be kept clean, though cleaning them does not strengthen them. When a rotten sidewalk goes down with a man, he sustaining serious injuries, damages are demanded and allowed, but when a rotten boiler goes up the case is different. "Low water, undoubtedly," the man should have had another pailful of water in the boiler, you know.

Of course a good many boiler explosions are caused by low water, but to claim that 90 per cent. are thus caused is putting the estimate too high. I think that 89 per cent. is nearer the mark. J. E. McConnell.

A Shopman's Advice to Apprentices.

Editor American Machinist:

Apprentices ought to receive more encouragement to make themselves more proficient in the trade. Many bright boys are wasting valuable time, even when at work, by not studying the details of the art upon whose mercy they have thrown themselves. Why is it that so many incompetent machinists are turned out annually from the best shops in the country, while excellent hands come from shops where even primitive tools are scarce?

Some say true machinists are born, not made; but I think the average youth pays too little attention to the means at his command of acquiring skill. Wrong associates give false ideas concerning the machinist's art, which rapidly develops itself by inferior work. Boys should try and see the art in a

higher light than the mere means of gaining a living. Working at the old thing every day, and waiting for the boss to get out of sight to have a good time, will not learn you the trade, and it will not come to your hands without being sought after. Many boys go out into the world without their art being acquired, and they think themselves contemptuously treated by having to hunt from shop to shop; but that is the consequence of their inferiority as workmen. Want of application at the proper time has brought them to that condition of inferiority.

But in these days, even close attention to details of shop operations will not make a man a first-class machinist in a wide sense. He must now study the principles of his art, which can only be found in the works of those who have traveled in the higher walks of the trade. Less getting round, having a good time, and more reading and study of mechanical literature, is needed among the boys who wish to rise in the business. The uneducated machinist is rapidly falling behind. The successful machinist grasps their secrets from the metals, and his skill in working them is brought to perfection only by diligence and close observation, which are all parts of a mechanical education. Remember, boys, that cleanliness is next to godliness, and do not expect that your skill will be appreciated unless your tools and surroundings are clean and neat. People who are slovenly in keeping up the appearance of valuable tools, cannot be expected to be very careful about the work they produce.

There is another subject that all trained machinists should be particular about. That is, not to countenance with their aid the incompetent tramps, who go from shop to shop calling themselves machinists. If men of this class were not continually getting help from competent mechanics, to get them out of tight places, their race would soon run out. What fools these mortals be! Think of men reaching out a helping-hand to the things that are taking their bread away. These men should receive the cold shoulder at all times, and especially when they call for trade help. That is the way to exterminate them.

SHARP.

Governor and Steam Pipe Dimensions.

Editor American Machinist:

I inclose a table from the circular of the Gardner Governor Company, showing the proper sizes of governors for throttling engines at various piston speeds.

As this is also a table of steam pipe diameters, it may be of interest to your readers. The table is calculated from the formula:

$$\delta = \sqrt{\frac{D^2 \times P}{6000}}$$

n which δ = diameter of steam pipe, D = diameter of cylinder, P = piston speed in feet per minute. Smaller pipes should not be used for throttling engines, and some automatic engine builders use larger. For automatic engines a constant of 5000 gives good results. A. E. LEAVITT.

SIZE OF GOVERNOR—DIAMETER OF OPENING.	¾	1	1¼	1½	2	2¼	2½	3	3½	4	4½	5	6	7	8	9	10
Diameter of cylinder—300 feet, piston speed.....	4	5	6	7	9	10	12	14	16	18	20	22	26	31	36	40	45
" " 400 " "	3	4	5	6	8	9	10	12	14	16	18	20	23	27	31	35	39
" " 500 " "		3½	4½	5	7	8	9	10	12	14	16	18	21	24	28	31	35
" " 600 " "			4	4½	6	7	8	9	11	13	15	16	19	22	25	28	32

Gain by Using Chimney Heaters.

Editor American Machinist:

I would say, in reply to Mr. Rice in his letter on boiler feeding, in your issue of October 6th, that where we turn our waste heat into the chimney heater at 400° Fahr., with the quantity of water passed through the heater, it is hardly possible to obtain higher temperatures than that reported (230°). There are times when the temperature will run far above the average.

Circumstances do not permit of an arrangement for chimney heaters where greater advantage can be taken than is now in this case. If Mr. Rice gained 100° Fahr. by the use of chimney heater, and the resulting temperature is only 300°, something must be wrong with his exhaust heater, as a good exhaust heater should heat the feed-water to 212°—at least we have no difficulty in getting that temperature constantly. THOUGHT.

How to Make a Small Boiler.

Editor American Machinist:

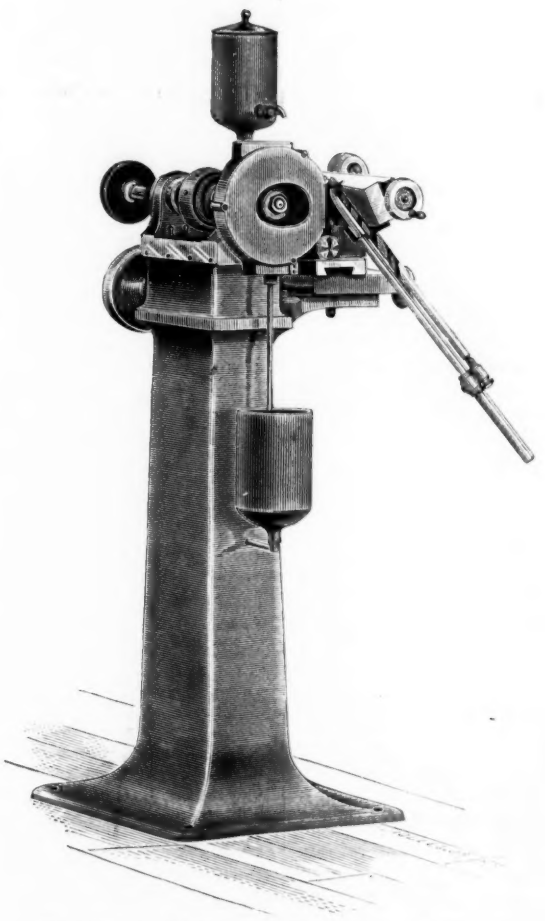
I am a constant reader of your valuable paper, and have been greatly benefited by it, especially by the "Letters from Practical Men." I believe in rendering assistance as freely as we accept of it, and will endeavor to suggest a plan for a small, safe, and quick steaming boiler—one that will meet the requirements of your correspondent of a recent date. I have had some experience in that line, having worked on boilers that were tested to 800 pounds.

He can make a boiler by coiling up a sufficient quantity of ¾" and 1" pipe to give heating surface enough to do the work he wants. The first coil should be about 8" in diameter, of ¾" pipe, and ten or twelve turns high. The next coil should be just large enough to pass over this one without touching it, say ¼" clear on all sides. It can be of the same size pipe, and same height. So on until he has heating surface enough. If there are more than two coils, the outer ones should be of 1" pipe, as the ¾" coils, if of too long run, will deliver superheated steam. After the coils are all made, get a piece of 6" pipe, 18" longer than the height of coils, with both ends securely capped (heads welded in are the best). Drill and tap the center of one head for 1¼" pipe, and screw a nipple in to stand up on the inside to about the line of the top of grates. All below the top end of this nipple will be mud-drum, owing to the water below that point being quiescent. On the outside end of nipple screw an elbow, and to this connect a pipe with openings corresponding to the radii of the coils. On the low side of the coils have an elbow standing down. Having an equal number of openings and coils, connect them with right and left nipples. After connecting the low side of coils to the bottom of drum, the top of coils are to be connected to the side of drum. This will have to be done with a union or running thread, as the coils will not spring enough to allow the right and left coupling to be used.

By this arrangement of parts the coldest water from drum is fed in the bottom of coils to be made into steam, and the coils themselves, being spiral, facilitate the flow of water and steam to the drum, where the water gives off its steam and returns to the bottom again (depositing its sediment in the bottom of drum), thus giving perfect and absolute circulation. This plan gives a very effective heating surface. There being nothing but screwed joints, there is no liability to leakage, and a boiler constructed in this manner will stand a pressure of 300 pounds with perfect safety. All the drum above the top of coils is steam dome. The whole can be set in an ordinary flue tile or a sheet-iron jacket lined with some non-conductor; of course, there will be a bonnet or covering over the whole, with the stack around the steam drum.

The grates should be sufficiently high to allow room below for ash pan, and the bottom of coils far enough above the grates to give a good fire-bed.

JAS. MILLTON.



THE PRATT & WHITNEY TWIST-DRILL GRINDER.

Important Discovery of Iron Ore.

An important discovery of iron ore has been made in the neighborhood of Milltown, Pa., which will greatly reduce the cost of iron and steel in Pittsburgh, should the ore prove to be of the quality first reported. It is said to be a hemitite free from phosphorus or sulphur contamination. If this is correct, the blast furnaces in Pittsburgh which now use up between 2,000 and 3,000 tons of ore a day, brought mostly from Lake Superior, will be able to obtain their raw material at a greatly reduced expense. The region where the ore is found is reported to be within the natural gas belt of Pennsylvania. If natural gas can be obtained in sufficient quantity to be utilized largely in iron-making operations, the discovery will exert an important influence upon the whole iron trade of the country.

A railroad spike has just been invented by William H. Bailey, of Minneapolis, Minn. It is a common spike, twisted to form a spiral, and it has a small spur at the point to facilitate its entrance into the tie. When driven, we believe it will hold like a screw, but if it turns in going inward it will be difficult to hit the head on to the lip of the rail.

The Pratt & Whitney Twist-Drill Grinder.

The engraving of a twist-drill grinding machine represents the one made by the Pratt & Whitney Company, Hartford, Conn. It is adapted for sharpening any twist drill from ¼" to 1½" inclusive. In machines for this purpose it is essential to center the drill to be ground very accurately, and to bring the corner of the second lip, in turning around, to exactly the position occupied by the first one when the first cutting edge or lip is ground. This is accomplished by holding the drill in a peculiar two-jawed chuck, the jaws of which are opened and closed by the operation of a right and left hand screw, turned by a hand-wheel. These jaws catch the drill quite close to the cutting lip, so that if the drill is slightly sprung from any cause the grinding will be true with that part of it. One of the chuck jaws has a projecting edge against which the edge of the groove in the body of the drill rests, quite close to the corner of the lip. In reversing to grind the other cutting lip, the corresponding edge of the other groove rests against this projecting edge, thus in each case centering the drill, and insuring the lip being in the correct position when ground.

The stop, against the screw of which the end of the drill is shown resting, is quickly adjusted and clamped for any length of shank, while small adjustments are made by means of the screw stop. Having been adjusted for grinding the first lip, the drill is turned around for grinding the second without altering this adjustment, which insures the necessary accuracy in this respect.

Clearance is ground by swinging up the lever along which the drill lies, this clearance being changed to suit different purposes for which the drills are to be used.

The wheel used is 7" diameter, with a face of 1", and is entirely enclosed in a cast-iron casing, dust proof, with the exception of a small opening against the wheel. The wheel may be run either wet or dry, provision being made for catching the drip when run wet, and the dust when run dry.

The main grinding wheel is at one end of the arbor, and at the other end is a small wheel shaped to the inner curve of the lip. This is used for shaping the inside of the point, and is an important addition. The countershaft is fitted with tight and loose pulleys 6" diameter and 1½" face.

The details and construction of this machine (one of which is on exhibition at the American Exposition at Boston) are excellent. The weight is 375 lbs.

The steamer *Colorado* exploded one of her boilers near Buffalo on September 30th and killed four men, besides inflicting terrible injuries upon seven others. The indications are that the engineer in charge and his assistant were so drunk that they did not know what they were doing, and that the steam-pipe from the exploded boiler to the engine was shut off. When the explosion occurred, the engineer was on the top of the boiler trying to fasten down the safety valve to prevent the steam from blowing off. When examined as to the cause of the accident he alleged that it was a mystery, and he believed the boiler sheets must have become crystallized. It is just in connection with the employment of such men in important trusts that mystery and crystallization theories find believers and advocates when boilers go to pieces through gross mismanagement and recklessness.

Engineer John Hilton, of the Atchison, Topeka and Santa Fe Railroad, died a heroic martyr to duty. A gang of train robbers attacked the train Hilton was pulling, at a small station in Western Kansas, and to better carry out their designs they tried to make Hilton pull out from the station. But he refused to move the engine, and fell dead in the cab with a bullet through his heart.

Fred H. Gates, of the Y. M. C. A., Rockford, Ill., writes us: "We expect to organize a class in mechanical drawing soon; also to tender a reception to the machinists of Rockford."

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NEW YORK, OCTOBER 20, 1883.

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Condition of the Machinery Trade.

Reports from various sections of the country indicate that, while the machinery business is not as brisk as it was one year ago, there are comparatively few complaints about dullness. Steam-engine builders are generally quite busy, one cause for which is the extensive drouths this year, causing a demand for steam motors to do the work heretofore obtained from water-wheels. Machine tool builders have fewer orders for the future than in any other October since 1879. One cause for this is a great increase of capacity, both by the starting of new tool-building shops and the enlargement of old ones. Locomotive works are engaged to about their full capacity. While new railroads have not been pushed to completion as fast as in 1882, over 4,300 miles of new track have been laid from the 1st of January up to the present writing. Earnings of railroads are generally greater than they were one year ago. Where no new mileage has been added, the earnings in most cases show an increase per mile. All that can be said about the future of the machinery trade is mere speculation. Fair crops, with a large prospective demand for export, constitute one favorable feature. An element of the situation that has a direct bearing upon the demand for machinery, is the fact that many new manufacturing establishments are being erected. The erection of new car, locomotive, and repair shops for railroads is probably greater this year than ever before. New shops are either now in progress or will soon be erected by the New York, West Shore and Buffalo; the Northern Pacific; the Pennsylvania Company; the Georgia Pacific; the Reading; the Chesapeake, Ohio and Southwestern; the Chicago and Alton; the Grand Trunk; the Canadian Pacific; the East Tennessee, Virginia and Georgia; the Cincinnati, New Orleans and Texas Pacific; the New Orleans and Northwestern; the Providence and Worcester; the Boston and Lowell; the Galveston, Houston and Henderson; the Wilmington and Weldon, and several other railroads. When completed, these shops will employ many hundreds—probably thousands—of additional mechanics. The fact is becoming every day more apparent that the proportion railroad mechanical work bears to the whole amount of mechanical work in the country is steadily increasing.

Brooklyn Bridge Troubles.

Up to the date of this writing, various attempts have been made to carry passengers across the Brooklyn Bridge by means of the wire-rope transmission. The success has not been all that was expected, and the daily press with the would-be passengers have been quite unanimous in their condemnation of Col. Paine and his attempts to introduce some original devices. Our readers will call to mind the illustrations we recently published of the mechanism employed on the bridge, but the gripping device, which proves to be the troublesome part, we had no drawing of, and cannot form an opinion as to whether the difficulty is due to something that ought to have been foreseen, or what is perhaps more likely the case, that in the gripping device a problem has been met with upon which there was no precedent from which to arrive at correct conclusions.

It may be possible that the same plan used on the cable road at Chicago, if increased in size and power in proportion to the increase in size of cars and cable used on the Brooklyn Bridge, would have worked from the start, and it may also be possible that the Chicago plan may not be all that can be desired, and that Col. Paine is simply doing just what he ought to do in trying to devise a better one. If we rightly understand the Chicago system, the cable runs at a uniform velocity, and in starting the cars from rest to the speed of the cable, the cable is allowed to slip through the grip blocks. In this operation the cable is subject to as much wear as the blocks. In Col. Paine's system, as we understand it, the cable runs between idler wheels when the cars are at rest, and by applying brakes to these wheels and arresting their rotation the cars are drawn along, and when the rotation of the wheels stops the cars travel at the same speed as the cable. This plan would relieve the cable of friction, and if successful would prove, perhaps, the better plan of the two. We see no reason to condemn Col. Paine for making the experiment, and if every new invention is to be thrown aside at the first failure, the days of improvement have come to an end.

A Colored Mechanical Problem.

We have several times received letters from colored men who desire to learn the machinist's trade. Some of them had partly learned it. They had all experienced insuperable difficulty in getting into shops to work by the side of white mechanics, and asked our advice about where to apply for a favorable reception. We were unable to give these individuals the advice they asked for. Recently the colored men of the United States held a convention in Louisville. The Chairman of that convention, among other things in his address, dwelt upon the difficulty above mentioned. With some interest we read that address to the end, hoping that some remedy would be suggested. Here is the remedy he advocated: "Elevate one of our class to the Vice-Presidency, or to a position in the Cabinet, and our equality shall have been established." Such advice is worse than useless; it regards nothing but political activity and preferment. Industrial progress is what is needed. Colored men must have shops of their own, in which colored youths can learn the trades. In no other way can this mechanical problem be solved for the colored race. Atlanta, Richmond, and some other Southern cities have colored industrial schools, any one of which is doing more for the material advancement of the race than any half-dozen of their political leaders. The best thing for the negroes of this country would be to accept for real leaders the conductors of these industrial schools.

Premiums for Locomotive Engineers and Firemen.

At the time of the last meeting of the Master Mechanics' Association we called attention to the valuable report written by F. M. Wilder, on "The most Practical and best System of paying Premiums to Locomotive Engineers and Firemen to induce Economy in working Locomotives," and we expressed regret that the convention did not find time to discuss the report. While they are devising means to reduce operating expenses, we do not think the master mechanics can find a department of railroad expenditures so susceptible of reduction as the locomotive fuel bills. And the most practicable way to effect a saving in this line is to interest the engineers and firemen in keeping down the useless waste of coal. Properly proportioned locomotives are of great service in economical operating, but there has been a disposition manifested among our railroad men to expect too much from the machine, while no attention has been bestowed upon what can be achieved by human skill and intelligence. Expensive mistakes have often been made by owners of stationary engines, who purchased high-class engines guaranteed to work steam economically, and then expected they could be run without skillful supervision. There is a tendency among railroad master mechanics to fall into the same error. We are certain that a poor type of locomotive in the hands of a good engineer and fireman, who understand the principles of combustion and steam economy, and put their knowledge into practice, will show a better record at the end of the year than a first-class engine worked by men who are careless or incompetent. We have heard a great deal, said during the last few years, about the surprising economy of British locomotives compared with those running on our railroads. When the subject is investigated, every indication goes to show that the difference in favor of foreign locomotives is almost entirely due to care in operating. There a premium system, whereby the engine men profit directly by the practice of fuel saving prevails on nearly all roads. Its educational influence has the very best effect upon the men. Nearly all American engineers who have had the opportunity of watching British methods of locomotive engine running, have expressed astonishment at the rigid attention bestowed upon small savings. Were our American engine runners brought under the influence of a system where they would be interested in every pound of coal or pint of oil saved, the results achieved would be highly gratifying. But a reform of this kind cannot be carried out without careful organization. Mr. Wilder's report discloses the details of a plan which already works satisfactorily on several of our best-managed roads, and there is no reason why it should not be extended to all other roads that consider economical operating a matter of any consequence.

According to the report referred to, the first essential required to insure the success of the premium system is providing the means to obtain an accurate record of the amount of coal consumed, the mileage made, and the train pulled by each engine. Nearly all roads have facilities for showing the train mileage, but the prevailing methods followed at average coaling stations merely approximates the quantity of coal supplied to each engine. This must be changed. The report recommends that each coaling station be provided with a proper outfit of trestles, coal pockets, scales, etc., for handling the coal accurately. In practice, measuring of the coal is admissible, but it must be done correctly.

The quantity of coal to be used for each loaded car pulled is reckoned for the various divisions from a basis shown by experience to be correct for the different classes of locomotives. A division with heavy grades is allowed a greater quantity of coal than where the grades are light or the road level. When an engineer starts out with a train, the quantity of coal on his tender is charged against him, and every subsequent addition to his supply is also added to the account. The number of cars hauled and the distance run form the credit side of his ledger. When he returns from a trip, the coal remaining in the tender is leveled down and measured, so that the quantity left may be credited to him should he not take that engine out on the next trip. This has to be carefully watched when men are running the rounds as they do on some roads. At the end of the month the mileage of the engine with the number of cars hauled is all calculated, and if the engineer has saved any coal over the quantity allowed, he and the fireman are paid half its money value.

The system has been working very successfully on the Pennsylvania Railroad for some time, and it has also been introduced on the New York, Lake Erie and Western Railroad. The system inspires the men with emulation as to who will make the best record, and by this means the operating expenses are reduced.

The mechanics of Stamford, Conn., have started a local society for mutual improvement. The movement is a good one, and should be encouraged. As soon as we have particulars of the organization, will lay them before our readers. In most cities, small as well as large, where mechanical industries are carried on, such societies could be started with profit.

Literary Notes.

STEAM-HEATING, AN EXPOSITION OF THE American Practice of Warming Buildings by Steam. By Robert Briggs, M. Ins. C. E. New York: D. Van Nostrand, Publisher, 23 Murray and 27 Warren streets. Price, 50 cents.

This little book, No. 68 in the publisher's Science Series, is a reprint of the paper read by the author before the Institution of Civil Engineers. It contains valuable information on the subject of steam-heating, and incidentally on the proportions of steam pipes and their screwed ends with the fittings commonly used. A diagram, from which the various dimensions of elbows, tees, crosses and branches may be readily taken, will be found especially convenient. The manner of piping for warming buildings, the use of radiators, boilers, stop valves, as well as circulation and ventilation, are considered, and examples of the extensive application of the

system of warming by steam given. In the appendix, data and tables are given that govern the use of the appliances used for steam-heating.

This book is of value, not only to those engaged in steam-heating, but to all who are in want of information in regard to wrought iron pipes and fittings.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(327) Machinist, Chester, Pa., asks: Will you please tell me how to lay out a slide valve to cut off steam at any part of the stroke? *A.*—See an illustrated article on this subject in the American Machinist of June 23, 1883.

(328) J. W., Lima, Ohio, writes: I sometimes have orders to make castings of copper, and although I use ingot copper, cannot get sound castings. The metal runs all right but the castings are full of small cells If you can suggest a remedy I shall be greatly obliged. *A.*—It is very difficult—under ordinary circumstances impossible—to make solid castings of pure copper. If you will add a small quantity of zinc, from ¼ to ½ ounce to a pound of copper, you will probably have no further difficulty. Sometimes lead instead of zinc is used.

(329) C. H., Reading, Pa., writes: The stud on the saddle of some links is set in line with the center of the link, and some are set from 1″ to 1⅜″ out from the center. What difference does it make on the link die? Does it travel faster or not? *A.*—You seem to have exaggerated the distance the stud is placed behind the center of the link. It is placed behind the center of the link are for the purpose of equalizing the cut-off. The tendency of this arrangement is to increase the slip of the link block. Increasing the slip of the block in this case is the least of two evils.

(330) W. P., South Arlington, Mass., asks: Will you tell me if a wrought-iron pipe 10″ diameter and 24″ long, with a cap on each end, will answer for a small boiler, and what pressure of steam will it be safe to carry? *A.*—It will answer, but would not advise allowing the fire to come in contact with the caps. Such a pipe the thickness of ordinary gas pipe of that size should stand a pressure of 500 lbs. per square inch. As you do not probably want to carry more than one-quarter of that pressure, we should advise that you test it with water to a pressure of twice that you wish to carry.

(331) J. B., Danville, Pa., asks: 1. What is the highest steam pressure in every-day use in a steam engine? *A.*—We could not say. The steamer Anthracite, when tested at the Brooklyn Navy Yard, used steam of 350 lbs. pressure. The engines and boilers of the Anthracite were built on what is called in England the Perkins system, in which a steam pressure of 300 to 500 lbs. per square inch is employed. In the English translation (published in 1847) of a work on the high-pressure steam engine, by Dr. Ernst Alban, of Saxony, the author says he has experimentally used steam at a pressure of 1,000 lbs. per square inch in a steam engine.

(332) A. D., Brooklyn, N. Y., writes: I was recently examined as an engineer, and failed to pass because I could not give a rule for finding the horse-power and the heating surface of a boiler. I was also told that I was too young (my age is 19). Can you tell me how to answer the above questions; also where can I get a job without papers? *A.*—There is no rule for finding the horse-power of a boiler. The heating surface of a boiler is the surface exposed to the action of the fire and to the hot gases on their way to the chimney. Calculate all this surface in square feet, and you will have the heating surface. No papers are required to run a stationary engine, except in some of the larger cities.

(333) L. H., New York, asks: What is the best way to temper moulding cutters made of Jessop steel? *A.*—A good way is to draw to a proper temper in a lead bath. You will have to experiment to find the proper color to draw to; or better still, get an experienced blacksmith to assist you. Written instructions are of little or no use. 2. What will clean a brass hand-rail? *A.*—See answer to Question 313 in American Machinist of September 29. 3. What is the difference between a high and a low-pressure steam gauge? *A.*—A high-pressure gauge is one graduated to indicate high pressure, as up to 200 lbs. per square inch or more, a low-pressure gauge one to indicate pressure up to, say, 40 lbs. Perhaps you are confounding a low-pressure gauge with a vacuum gauge. The latter is for indicating pressure below the atmosphere. 4. What is the best way to set a horizontal boiler? *A.*—There are various ways of setting boilers, some of them patented, and we cannot say which is the best. What would be best under some circumstances may not be the best under other circumstances.

(334) J. B. W., New Brunswick, N. J., writes: I am running in a steamer from North Carolina to New York. We use salt water in the Chesapeake Bay, and when we get out of that into fresh water the tubes leak. I want to know—1. Why do our tubes leak in fresh water and not in salt water? Our boiler is of the locomotive type, and we have to drive it a little to make steam. The tube sheet is ½″ thick and the tubes not more than ¼″. Is it not possible that the difference in expansion has something to do with the leaking? *A.*—We hardly think this is the cause. We should be more inclined to think that the salt and impurities of the salt water operated to stop the leaks, and that this matter was dissolved by the fresh water. 2. We blow every hour, using the bottom blow-off always. What is the difference between using the bottom or the surface blow-off? *A.*—Solid particles in boiling water have a tendency to rise to the top, and more of such particles are discharged by blowing from the surface.

Business Specials

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Match Machinery, F. Chillingworth, New Haven, Ct.

F. VanWinkle, Mech. Engin'r, 22 Cortlandt St., N. Y.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N.J.

Improved Tack Machines,
Taunton Cotton and Machine Co., Taunton, Mass.

The latest Improved Match Machinery is made by the White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh Wells, & Co., corner Fulton and Dutch streets, New York.

Universal grinders for lathe-centers, chucks, angles, or cylinders. C.C. Hill, 144 LaSalle st., Chicago, Ill

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 58,) New York City.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders

For sale, lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St, Washington, D. C.

Lyman's Gear Chart How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

Jack pump and ladder chain machines, 40 to 80 links per minute, direct from coil. The Gaylord, Cross & Speirs Company, Waterbury, Conn.

William J. Baldwin, consulting engineer in Steam Heating and Ventilation. Author of "Steam Heating for Buildings." Office, 96 Fulton st., New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Young men wishing to take a mechanical course or learn the machinist's trade, call or address School of Mechanical Instruction, No. 195 Front street, Worcester, Mass.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant. $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

Bound Volumes of the American Machinist for 1880, 1881, and 1882. A limited number of each sent by express for $4 per volume, express charges to be paid by purchaser. Amer. Machinist Publishing Co., 96 Fulton st., New York.

Business men furnished stenographers, who are machine operators, without charge for my services. Shorthand taught by mail. Caligraphs sold; special inducements offered; correspondence solicited. W. G. Chaffee, Oswego, N. Y.

C. Wye Williams on "Fuel, its Combustion and Economy," edited by D. K. Clark, is being reprinted in full (144 illustrations), in supplementary parts, in "Steam" Lakeside Press, Chicago. $1 covers cost of book and paper one year. Sample copy, 10c. Theo. Audel, editor.

"HOW TO KEEP BOILERS CLEAN."—A book of seventy-two pages, telling how to prevent scaling, foaming, priming, and burning, with other valuable information, will be sent to any address FREE of postage, by James F. Hotchkiss, 86 John street, New York.

Any of our readers who have complete files of Volumes I. and II. in good condition, bound or unbound, can probably find a purchaser by addressing us, and stating the lowest price they will accept. American Machinist Publishing Company, 96 Fulton street, New York.

The H. W. Johns Manufacturing Co., New York, have been awarded the Silver Medal over all competitors at the Amsterdam Exposition for their Asbestos Materials, Liquid Paints, Roofing, Boiler Coverings, Steam Packings, Millboard, &c., &c. A substantial victory for American goods.

Slide valve working models, $2 each. Full size working drawings for making same, 25 cents. Shows effect of lap, lead, expansion, cushion, &c., at a glance. See notice in this paper, Vol. 6, No. 41, page 9. Will forward on receipt of money or stamps. Also "Useful Hints on Steam," 96 page book, mailed for 15 cents. E. E. Roberts, manufacturer of engines and boilers, 107 Liberty st., N.Y.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the American Machinist; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

Manufactures.

The new Winona (Minn.) Harvester Works buildings are to cost $45,000.

The Georgia Pacific Railroad Company is erecting new shops at Atlanta, Ga.

John E. King, Passaic Dye-Works, East Newark, N. J., is to put in a new boiler.

The Gibraltar (Ohio) Rolling Mill is being enlarged and new machinery is to be put in.

The Stanley Paper Mills, Stanley, N. Y., are putting in three boilers, each 125 horse-power.

The Pullman Iron and Steel Company will build a mill in Pullman, Ill., to make railroad spikes.

The Solid Steel Company, Alliance, O., propose to increase their force from 30 to 100 workmen.

E. H. Flood is about to erect a four-story factory building at Ninth and Dauphin streets, Philadelphia.

Smith, Hill & Co., Quincy, Ill., manufacturers of machinery, are about to move into their new shops.

The North & Judd Manufacturing Company, New Britain, Conn., intend to enlarge their malleable iron foundry.

E. W. Blatchford, & Co., shot manufacturers, of Chicago, are building 80x100-foot addition to their works, three stories high.

The Palmer (Mass.) Wire Goods Company are putting up a new 100 by 40 feet factory, two stories high, just west of the wire mill.

J. Miner will build a new planing mill at Big Rapids, Mich., in addition to his old one that will be shut down for improvements.

The Norwalk, Conn., Lock Co., are building an addition to their works in the shape of a foundry and machine shop.

R. D. Hubbard, of Mankato, Minn., and T. P. Gere, of Sioux City, Ia., are about to erect at the latter place a linseed oil mill, to cost $75,000.

The works of the Knickerbocker Manufacturing Company, which will manufacture milling machinery, are rapidly going up at Jackson, Mich.

The Yadkin Falls Manufacturing Company, Concord, N. C., have begun the erection of a new factory building. It will be 100x52 feet, and two stories.

The Washburn Iron Company, of Worcester, Mass., are considering the feasibility of manufacturing their own steel for rails, at an expense of $150,000.

The extensive shops of the Canadian Pacific Railroad, at Hochelaga, are nearly completed. They are about to build large car-shops at Winnipeg, Manitoba.

The Philadelphia and Reading Railroad has commenced preparations in Reading for the erection of a new machine, pattern and carpenter shop, to be 300x55 feet.

The Grand Trunk Railway is erecting shops at Fort Gratiot, Mich. The main building is 507x80 feet. It will be used for machine erecting and blacksmith shop.

A large factory for the manufacture of hay forks and hay elevators is being erected in Muncy, Lycoming County, Pa., by Messrs. John Waldron and Charles H. Sprout.

D. E. Pierce & Co., Bethlehem, Pa., are building a two-story brick addition to their shop, 30x62 feet; also a foundry, 35x72 feet. They make iron valves and steam work.

A new company has been formed which intends to erect a sheet-iron mill at Chartiers, Pa. A tract of land has been bought, and work on the building will commence at once.

McCallum, Crease and Sloane are about to erect a factory at Wayne Junction, Philadelphia, Pa. One building is to be 42x100 feet, and another 59x222 feet three stories high.

The Deane Steam Pump Company, Holyoke, Mass., has bought out the Holyoke Foundry Company, which has been in active business about a year, employing about 60 hands.

The Geo. Wood Organ Co., of Boston, Mass., are intending to move to Middleboro, Mass, and a factory is being erected. Main building, 100x55; L extension, 40x60, three stories; engine-house, dry-house, stock, etc., at a cost of $17,000.

The Missouri Furnace Company, of Carondelet, Mo., are about to remove their blast furnaces to some point in Tennessee or Alabama. Cause—A freight charge of two cents per ton per mile on iron ore over the St. Louis and San Francisco Railroad.

The Pacific Can Company, San Francisco, Cal., manufacturers of cans under the automatic system invented by Edwin Norton, of Chicago, are about to start a machine shop in connection with their works, for the manufacture of dies and special tools.

M. E. Campfield & Co. have built a factory in Cleveland, O., to make a new screw wrench. This tool has a solid handle, with enlarged ferule, screw head enclosed by the ferule, with its strong support, thus guarding against split handles, broken shanks, and nuts dropping off.

The work on the new Panhandle Railroad shops, northeast of Columbus, O., is going forward very rapidly. The excavation is being rapidly pushed, aed the contractors, Cramer & Horn, are receiving 50,000 bricks per day, and promise that the shops shall be completed before Winter sets in.

The new foundry company at Dighton, Mass., has taken the name of "Groveland Foundry Company of Dighton," and has been organized with a board of seven directors. H. M. Simmons is president, and George A. Shove treasurer and clerk. Dighton has many advantages for carrying on the foundry business.

The Hancock Inspirator Company, Boston, Mass., has purchased a lot 200 feet front, upon which they will commence to erect new shops for the manufacture of inspirators and water meters as soon as the plans for building are completed. Their rapidly extending business is already too large for their present quarters.

The Norfolk and Western Railroad Company has had recorded contracts for building nine powerful engines, seven first-class passenger coaches, 100 box cars and 700 coal cars, involving an outlay of several hundred thousand dollars. The Baldwin Works, at Philadelphia, are to build the engines, and W. C. Allison, of Hagerstown, and Bowers, Dure & Co., of Wilmington, the coaches and cars.

The citizens of Chattanooga, Tenn., have appointed a committee to purchase twenty-five acres of land to be presented to the Cincinnati, New Orleans and Texas Pacific road for the location of its principal shops, which will be fitted up with a view to the construction of all the rolling stock of the company at this point. The foundations of the division shops at Meridian, Miss., are nearly completed.

It is rumored that a syndicate has been talked of to help the Howe Scale Works at Rutland, Vt., out of their financial embarrassment for the benefit of the town. A large amount of wages is due their men, and they are said to be otherwise embarrassed. The men and those in a position to know claim that they have large orders and do a profitable business, and that if they were disconnected from ex-Gov. Page's other business interests they would pay comfortably well.

L. G. Smith, of McComb, Hancock Co., Ohio, has got his new factory into succesful operation for the manufacture of long pitchfork and shovel handles. The main building is 35 feet by 80 feet, with a wing 20x20 feet, and the machinery is of the latest design. His motive power is a Ball automatic engine, which is adjusted to produce the remarkable result of acceleration of speed with increase of load. It runs 300 revolutions per minute when empty, and 215 when the machines are at work.

One of the neatest, best-arranged and clearly-printed catalogues that has come to our desk for many weeks is that of Mahony's Universal Patent Furnace, just issued by James Mahony & Son, 73 Astor House, New York. The engravings are excellent, and the descriptive matter renders the peculiar features of the furnace intelligible. Over 350 of these furnaces and improvements are now in use, and they seem to be gaining in popularity with engineers. The catalogue also contains several pages of useful information for engineers.

During the past year the East Tennessee, Virginia and Georgia Railroad Company have been expending very large sums of money upon their new shops at Atlanta, Ga., the amount thus far put out being over $100,000, and still the work of adding goes on. The main machine shop has just been completed, and the most improved and valuable machinery is being planted in the building. The repair shop and wood-work department, in which cars will be repaired and built, will soon be begun. They are said to be the most extensive railroad shops in the South.

Nathan & Dreyfus, 94 Liberty street, New York, have recently received an order from John Roach & Sons for four of their No. 10 ejectors. These ejectors are becoming popular as a means of removing the water from the holds of ships. Having no valves or moving parts to get out of order, they are more convenient and reliable than the ordinary bilge pump. Three ships of the Bremen line have been supplied with these ejectors, and they are very well liked. The Central Pacific Railroad also has some of them on their boats, and they deliver 300 tons of water an hour.

The Northern Pacific Railroad shops at Brainerd, Minn., employ 900 men, under the charge of H. J. Small, assistant superintendent of machinery. At the Fargo (Dakota) shops they employ about 30 men; under charge of A. Rupert, M. M. At the Mandan (Dakota) shop 30 men are also employed, under E. F. Doran, M. M. At Sprague (W. T.) shops 175 men are employed, under charge of W. T. Small, assistant superintendent of machinery. The shops which they will erect next year at Portland, Oregon, and St. Paul, Minn., will employ a very large number of men.

The Boston *Commercial Bulletin* says: "Mr. Geo. F. Ballou, formerly with the Waltham Watch Company, and Professor W. A. Rogers, of Harvard, have been encouraged by some Hartford gentlemen to come to that city and begin the manufacture of precision screws, fine dividing engines, and astronomical and scientific instruments. They start with a capital stock of $25,000, all owned in Hartford. In less than a month they will be in good working order. They have already several good orders ahead for work. Gentlemen identified with local manufacturing interests saw a good field for this class of work, and raised money enough to induce them to come here."

Machinists' Supplies and Iron.

NEW YORK, October 4, 1883.

Keuffel & Esser, 127 Fulton street, New York, are offering for sale "Helios Blue Process Paper" for copying drawings. This paper is manufactured by them, and is highly spoken of by those who use it. One of its merits is the facility with which it can be used by those unaccustomed to copying drawings by the blue process.

In iron we quote: No. 1 X Foundry, $21 to $21.50; No. 2 X Foundry, $19 to $19.50.

Scotch Pig—Coltness, $23.25; Glengarnock, $23; Gartsherrie, $23.50; Summerlee, $22.50, with lower prices to arrive.

Copper—Lake, 15¼c.; other brands, 14¾c. to 14¾c.

Spelter—Refined, 8c. to 8¾c.; Silesian, 5c. to 5¼c.

Tin in jobbing lots—Banca, 21¾c.; Straits and Malacca, 21⅝c. to 21⅝c.

✲WANTED✲

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—Several first-class moulders and machinists. Apply, Fort Scott Foundry and Machine Works, Fort Scott, Kansas.

A young man (at present engaged), thoroughly familiar with the clerical duties of a general machinery works, desires a similar position. Address, Timekeeper, AMERICAN MACHINIST Office.

Wanted—Competent mechanical draughtsman: one having experience in printing machinery preferred. Address, stating qualifications, age, &c., Abingdon, at office of this paper.

Situation wanted as superintendent by a thoroughly practical man; has had 25 years' experience in most all kinds of machinery; best of reference. Address B. W., care AM. MACHINIST.

Wanted—Parties traveling for other houses and selling to users of steam boilers, to take charge of a small and fast selling article; good references required and the kind of trade solicited. Address "Manufacturer," care AM. MACHINIST.

A reliable and competent mechanic desires a situation as superintendent or foreman. Experienced in management of shop and men, designing and constructing tools, fixtures, etc., for the economical manufacture of duplicate, or interchangeable work. Good references. Address, Box 2, AMERICAN MACHINIST.

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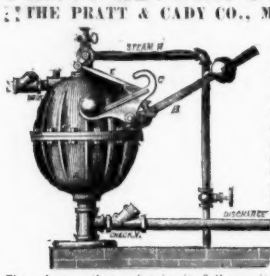

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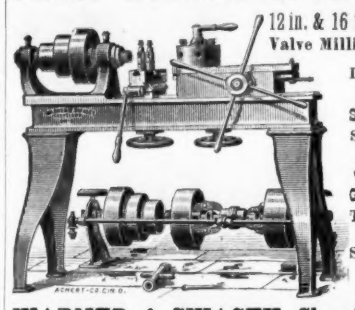

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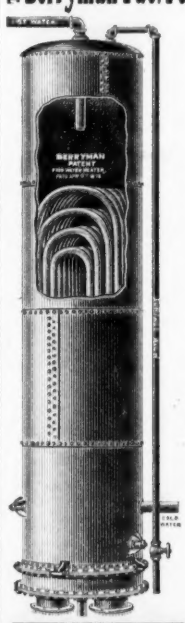

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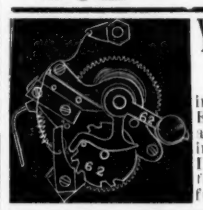

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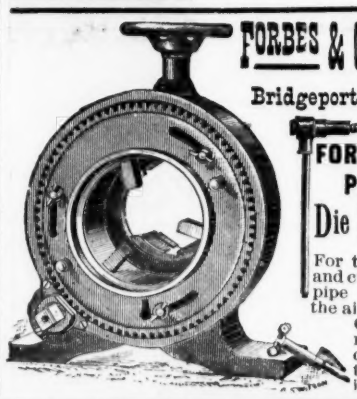

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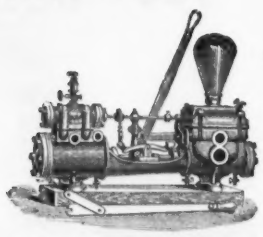

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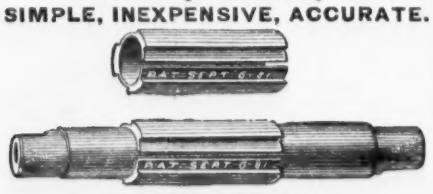

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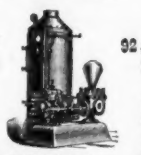

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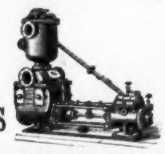

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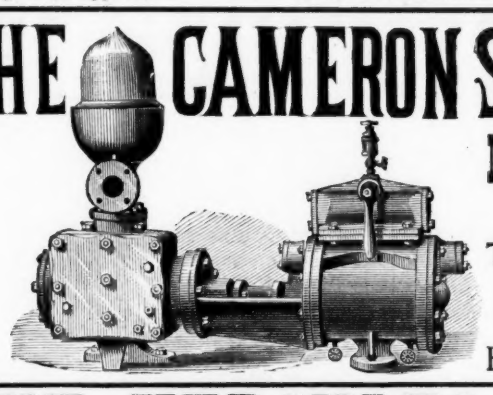

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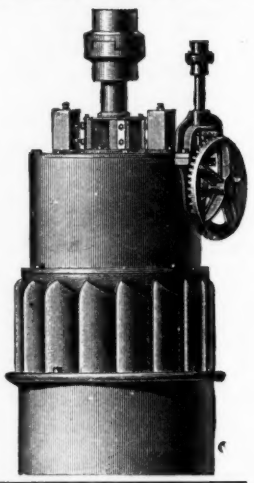

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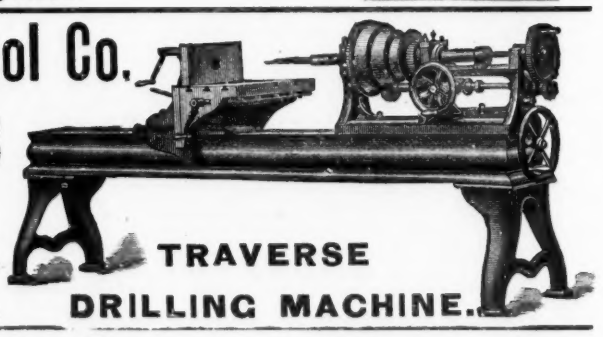

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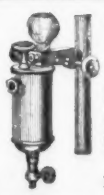

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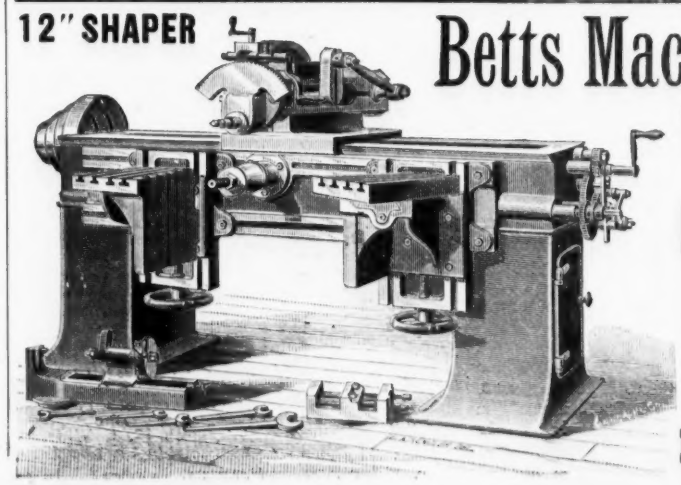

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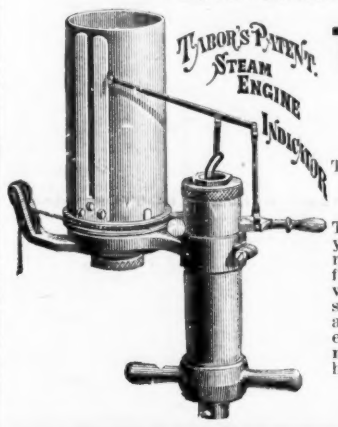

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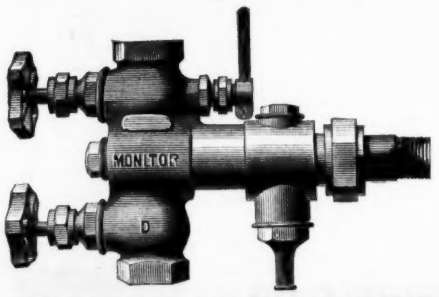

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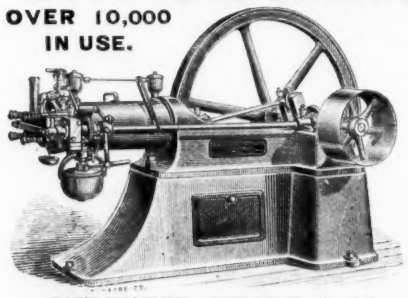

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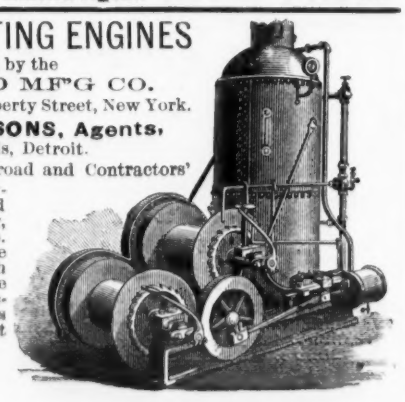

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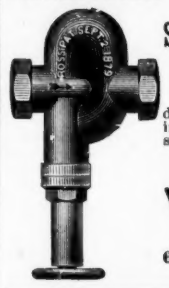

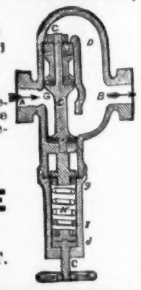

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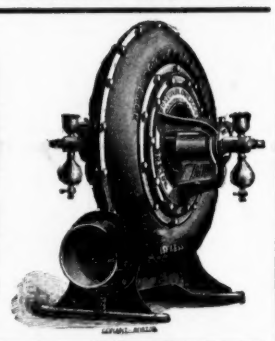

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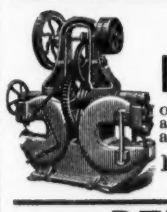

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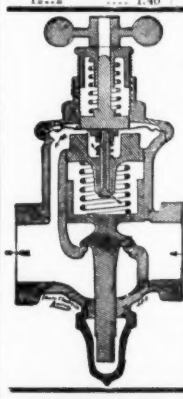

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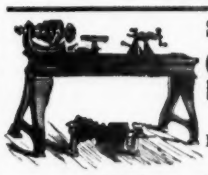

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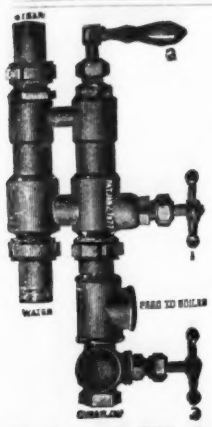

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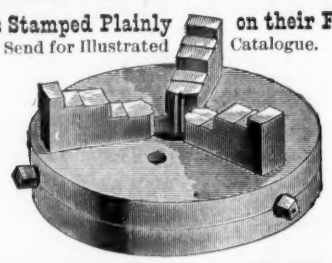

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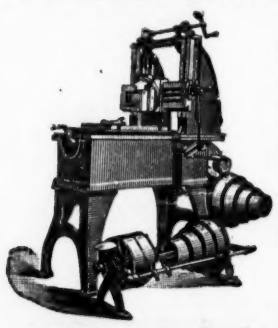

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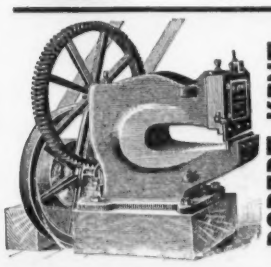

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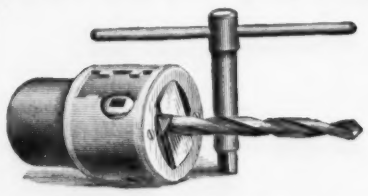

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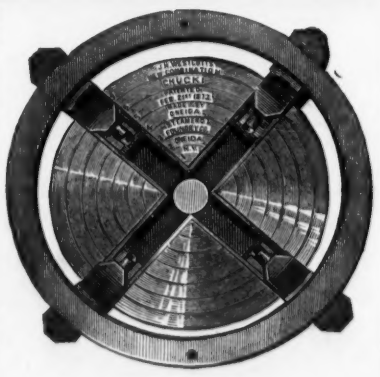

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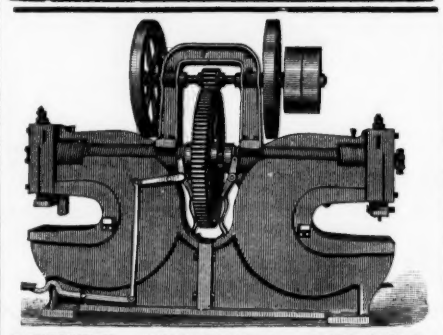

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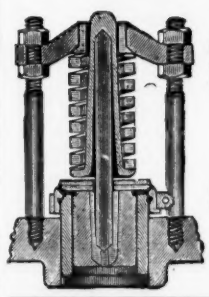

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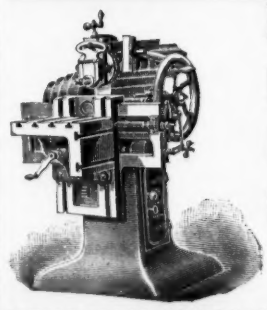

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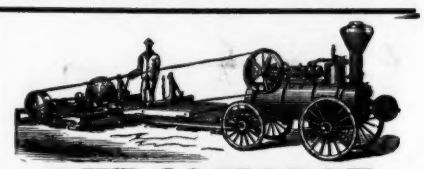

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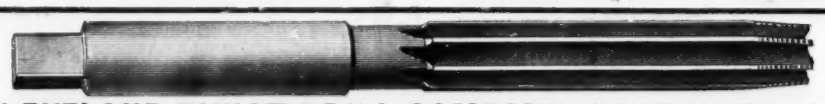

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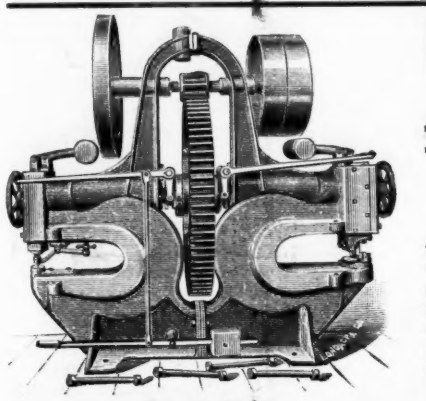

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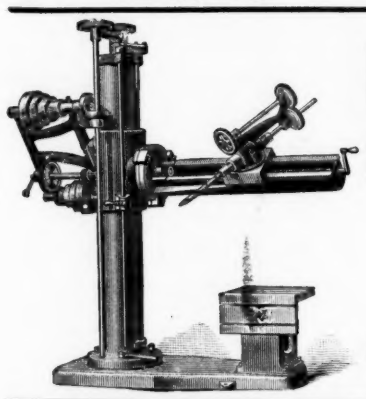

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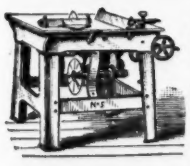

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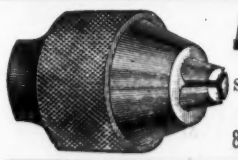

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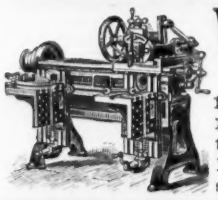

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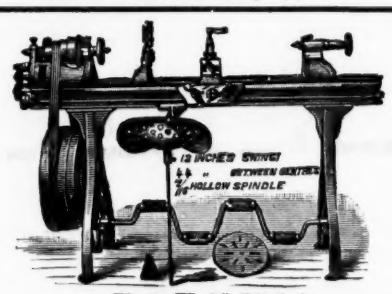

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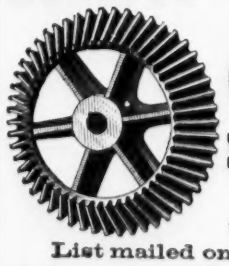

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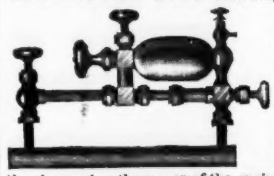

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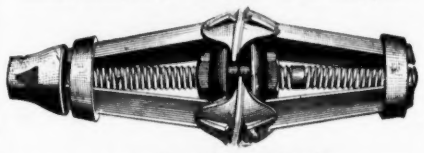

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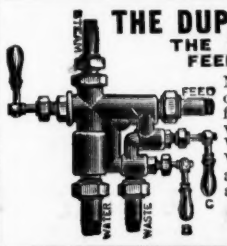

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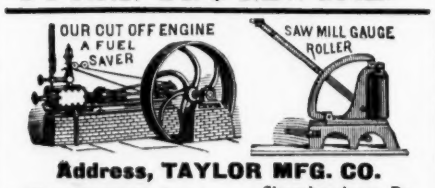

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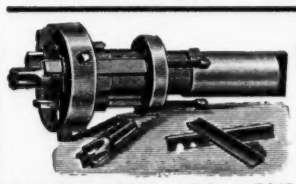

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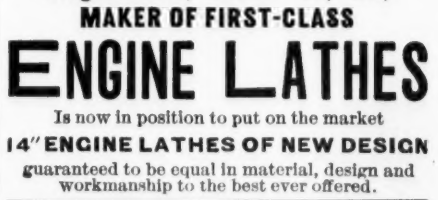

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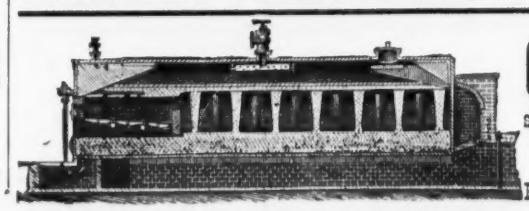

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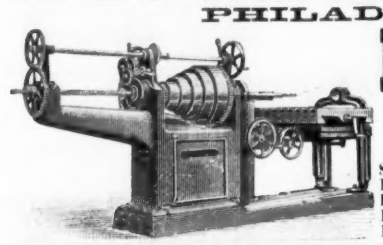

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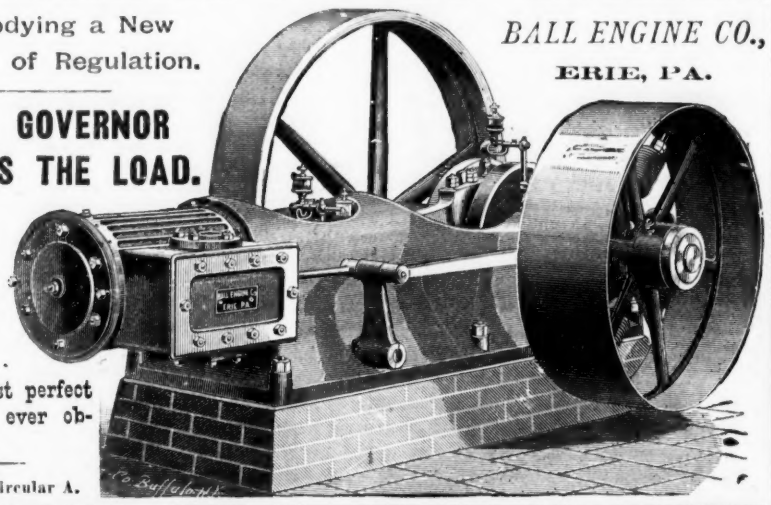

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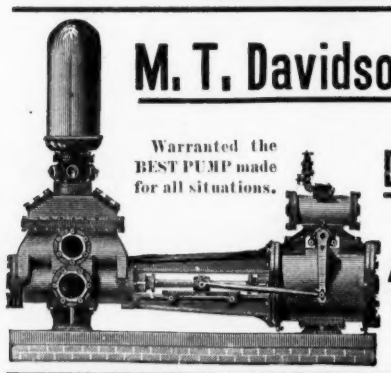

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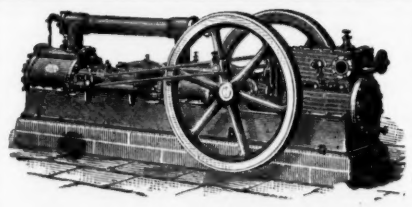

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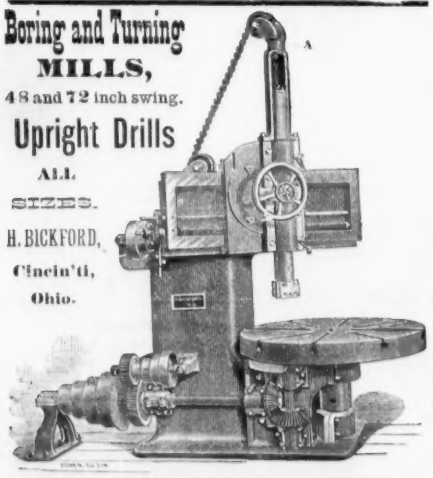

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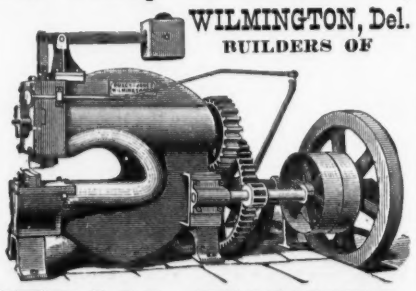

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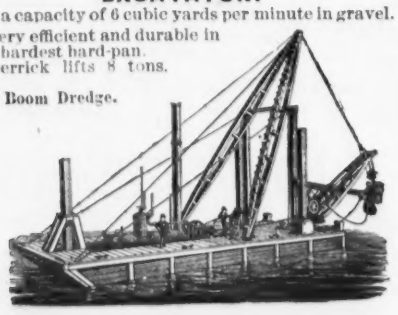

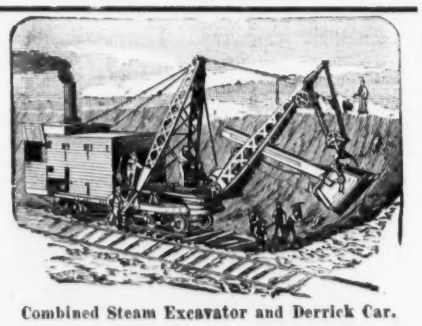

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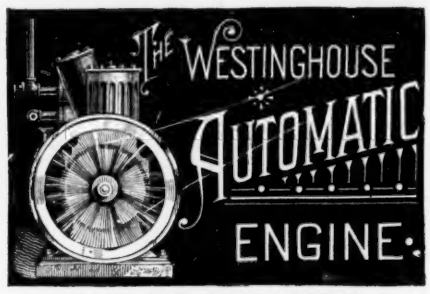

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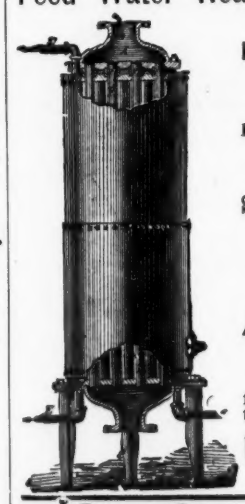

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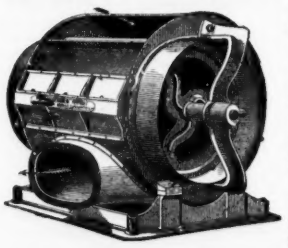

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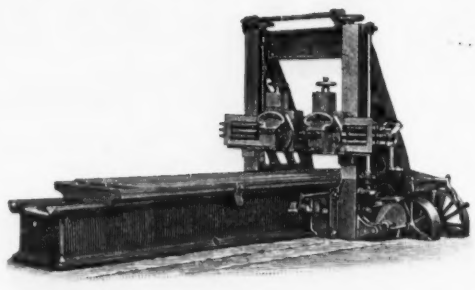

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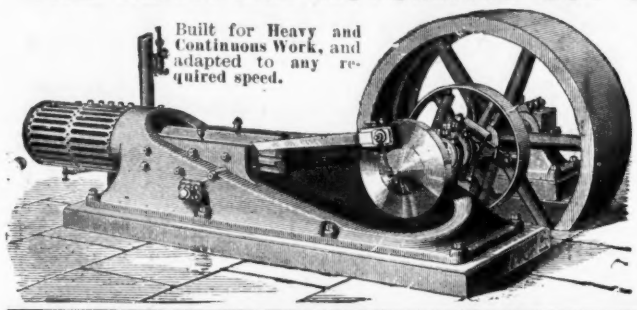

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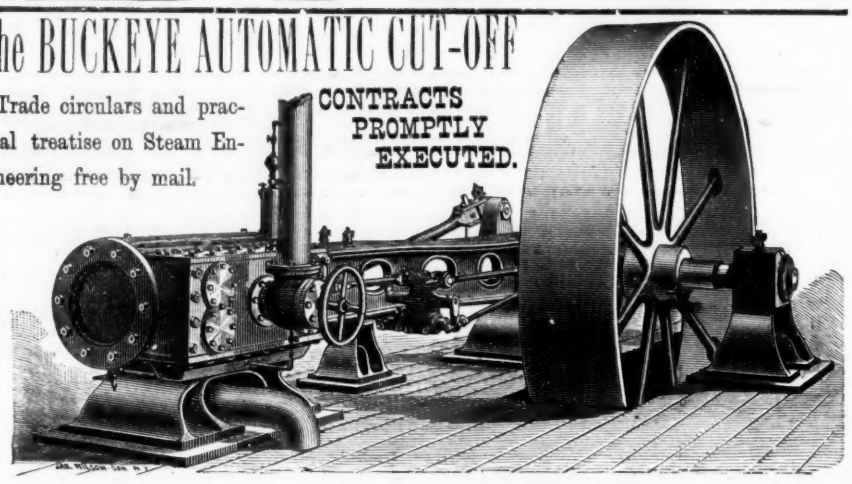

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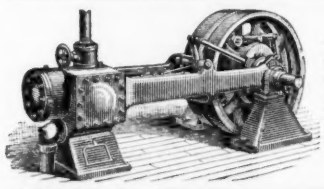

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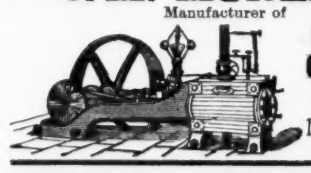

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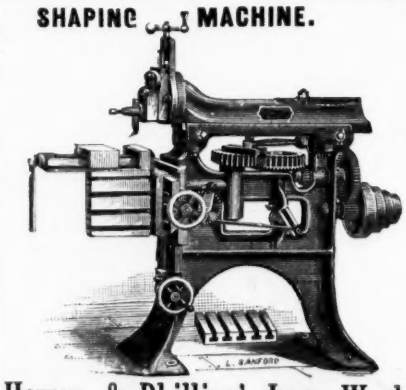

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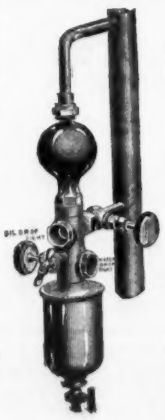

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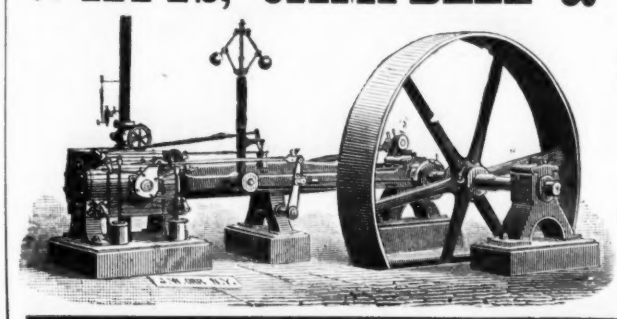

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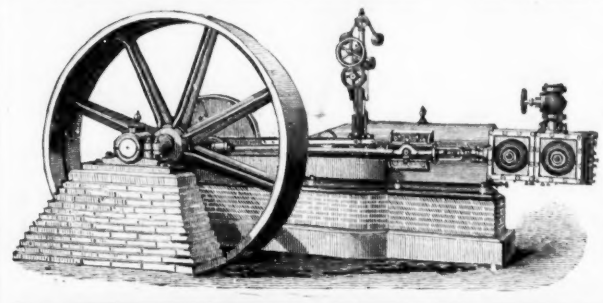

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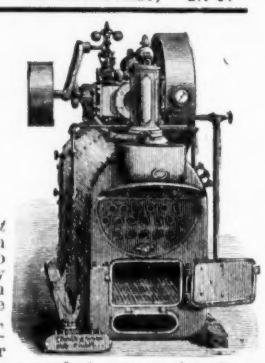

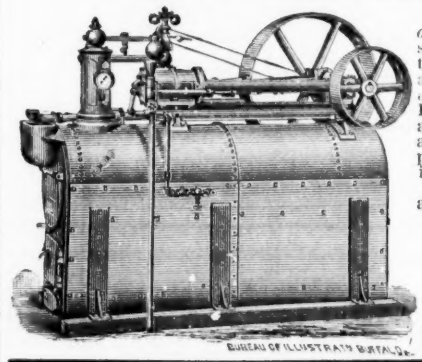

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One " each 6 and 8 feet bed, 16 in. swing.
One Engine Lathe, 6 feet bed, 15 in. swing.
One " 5 " 11 "
Two Iron Planers, to plane 8 feet, 30 x 30 in.
Two " to plane 7 feet, 26 x 26 in.
Two " to plane 4 feet, 22 x 22 in
One each 22, 24, 26, 30 and 38 in. swing B. G. S. F Upright Iron Drills.
One Shaper, 15 in. stroke.
One Shaper, 12 in. stroke.
One Bolt Cutter, to cut 2 in.

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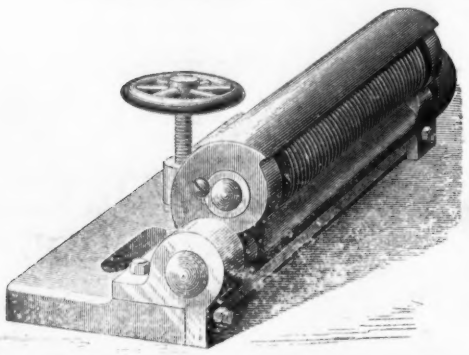
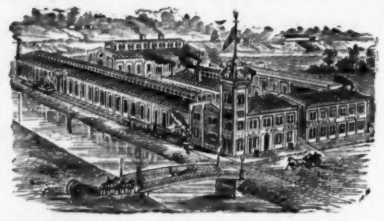


One of the most disagreeable things to be done in a workshop is the Truing of Grindstones. It is, therefore, often the case that they are allowed to become quite out of shape and untrue, very much to the annoyance of the workman, who finds it almost impossible to grind his tools in a proper manner. The above cut illustrates a device which is well adapted for truing and keeping the face of grindstones constantly in good shape. This can be instantly applied to the face of the stone, working automatically, without interfering with the constant use of the stone, and does the truing without raising any dust



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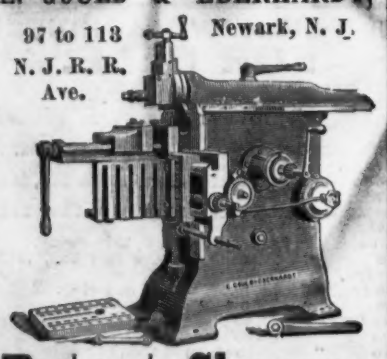

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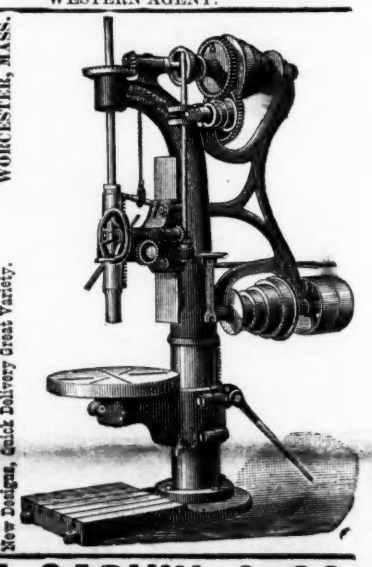

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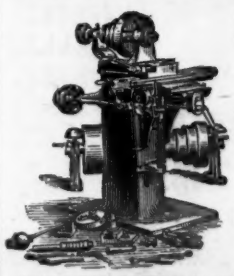

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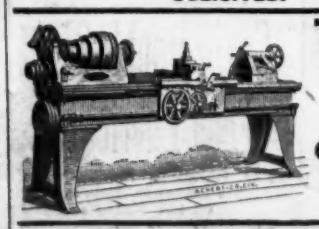

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